Appendix D

Graphs for Projected Maintenance Monitors Design Value Trends

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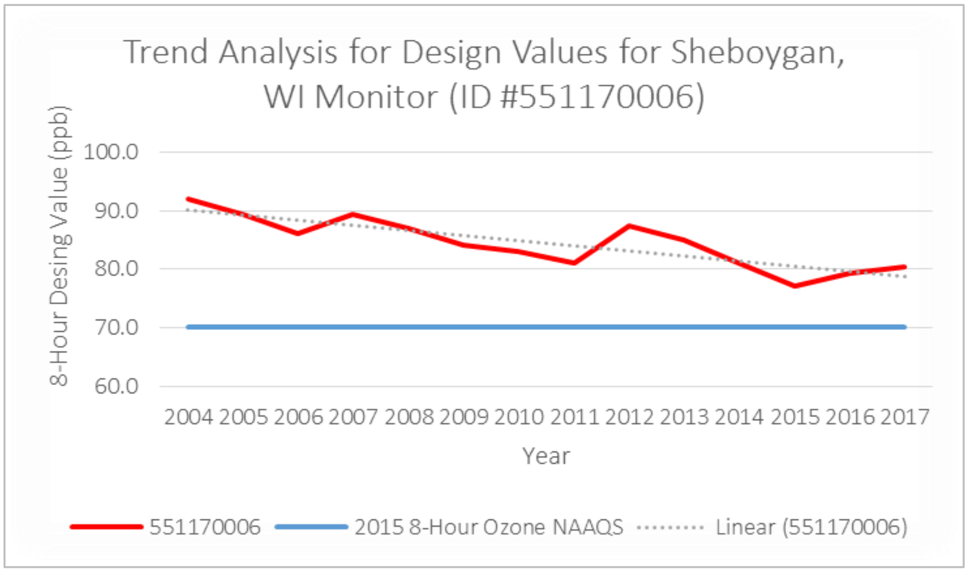
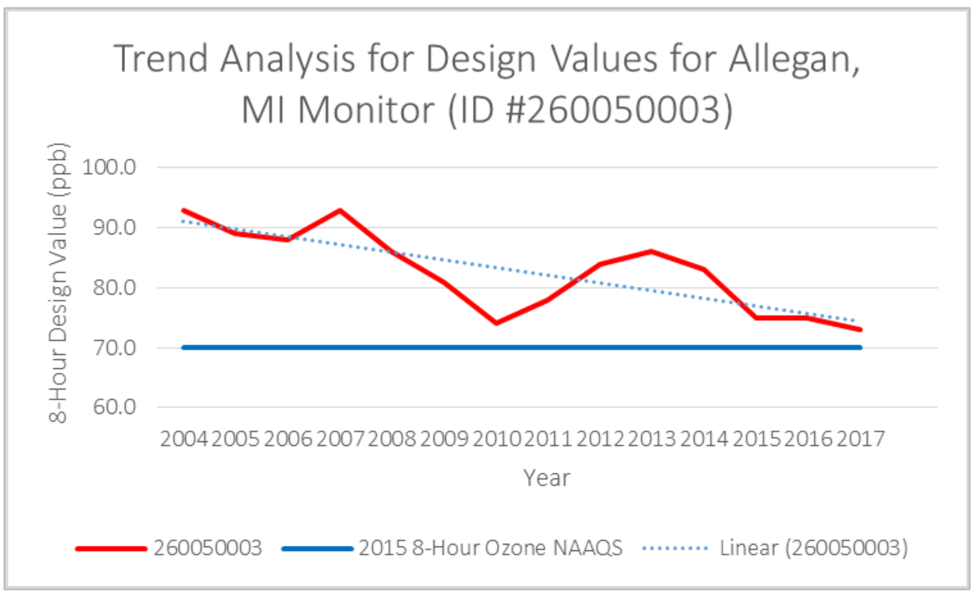
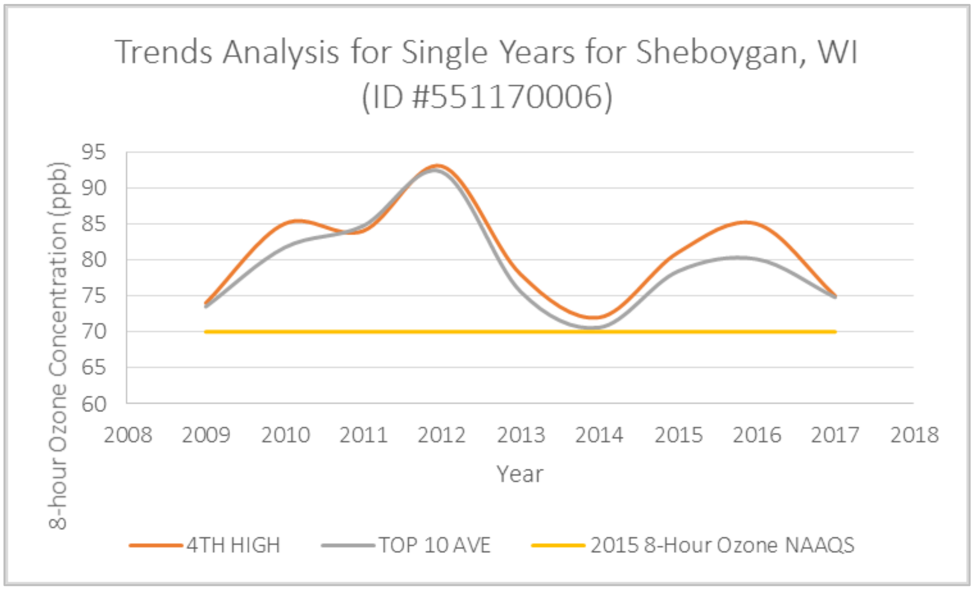
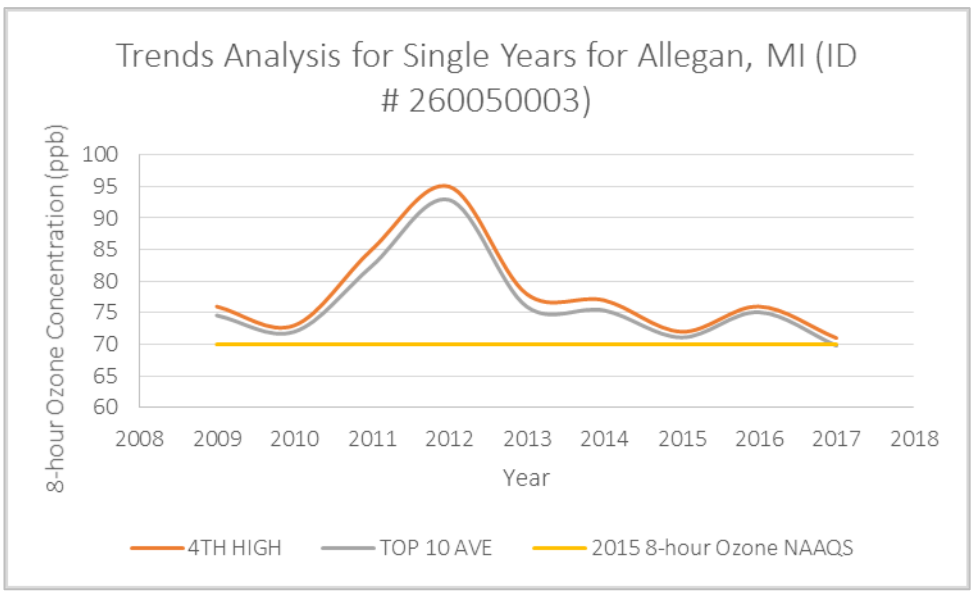
Design Value Trends



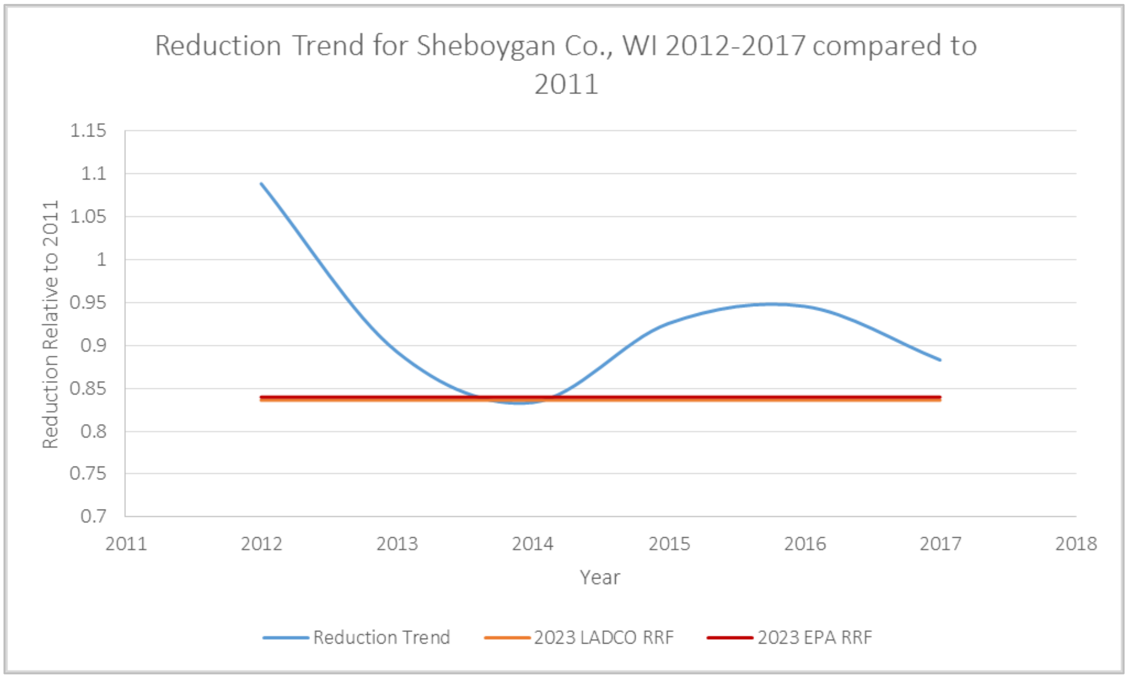


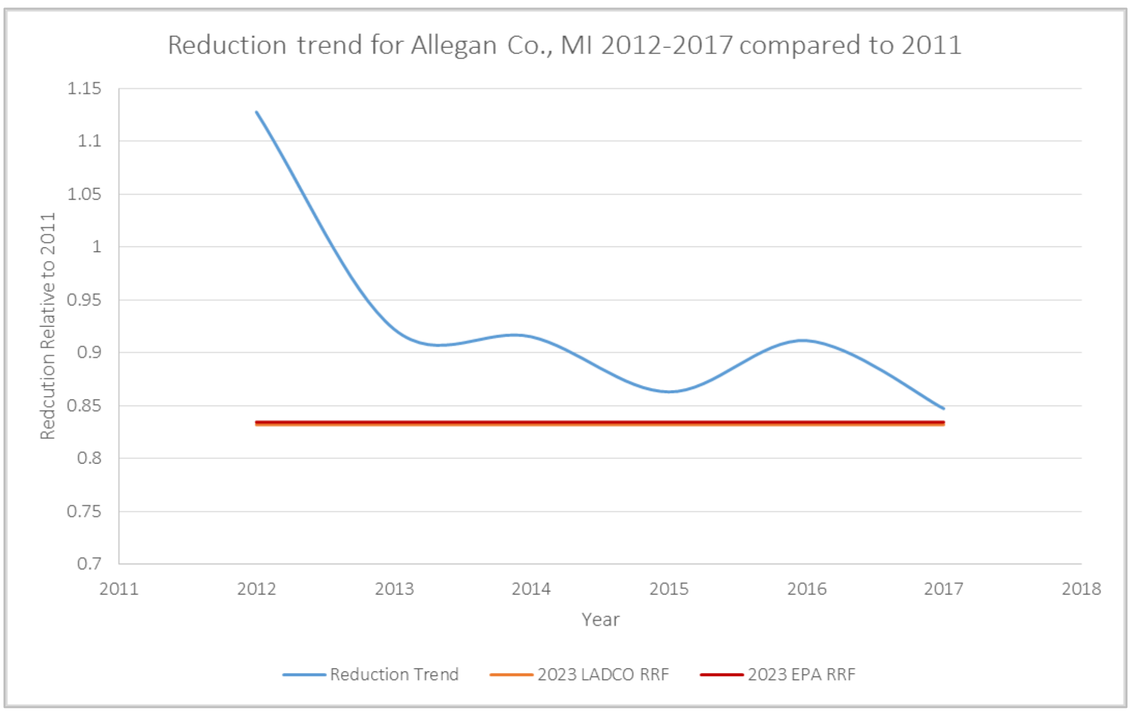
Single Year Trends





Reduction Trends





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Appendix E

U.S. EPA "*Analysis of Ozone Trends in the East in Relation to Interstate Transport*" Presentation (May 14, 2018)

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Analysis of Ozone Trends in the East in Relation to Interstate Transport

Norm Possiel, EPA/OAQPS

May 14, 2018

Background and Context

- Recent analyses of measured data by some states suggest that the current ozone problems in parts of the Eastern US may have become more of local problem within the nonattainment area and nearby states, as opposed to broad regional problem with a large geographic reach far upwind of the downwind state.

- In this analysis we examine ozone trends and spatial patterns based on measured data in urban and rural/regional locations to further understand the extent to which high ozone concentrations remain a regional problem in the East or if high ozone concentrations in have become more of a local problem.

Analytic Approach

- This analysis focuses on comparing ozone in 2010/2011/2012 to ozone in 2015/2016/2017.
    - 2010/2011/2012 were each very conducive for ozone formation in parts of the East.
    - 2015/2016/2017 are the most current three years of data. Of these three years, 2016 was the most conducive for ozone formation in the East.
    - 2013 and 2014 were not included in this analysis because those years, particularly 2014, were not conducive for ozone formation in large portions of the East.
    - Note that the ozone reductions seen in measured data between the time period 2010-2012 and 2015-2017 are due to a combination of reductions in emissions and also inter-annual variability in meteorology conducive to ozone formation and transport.
- Part 1. Analysis of the spatial patterns in the number of summer days with measured MDA8 ozone exceedances of the 2008 and 2015 NAAQS.
- Part 2. Analysis of ozone trends at rural sites (mainly high elevation sites) upwind of the Northeast Corridor in comparison to trends at near-urban high ozone sites within the Corridor; similar analysis for rural sites in portions of Midwest and South compared to high ozone at key sites along the shoreline of Lake Michigan.

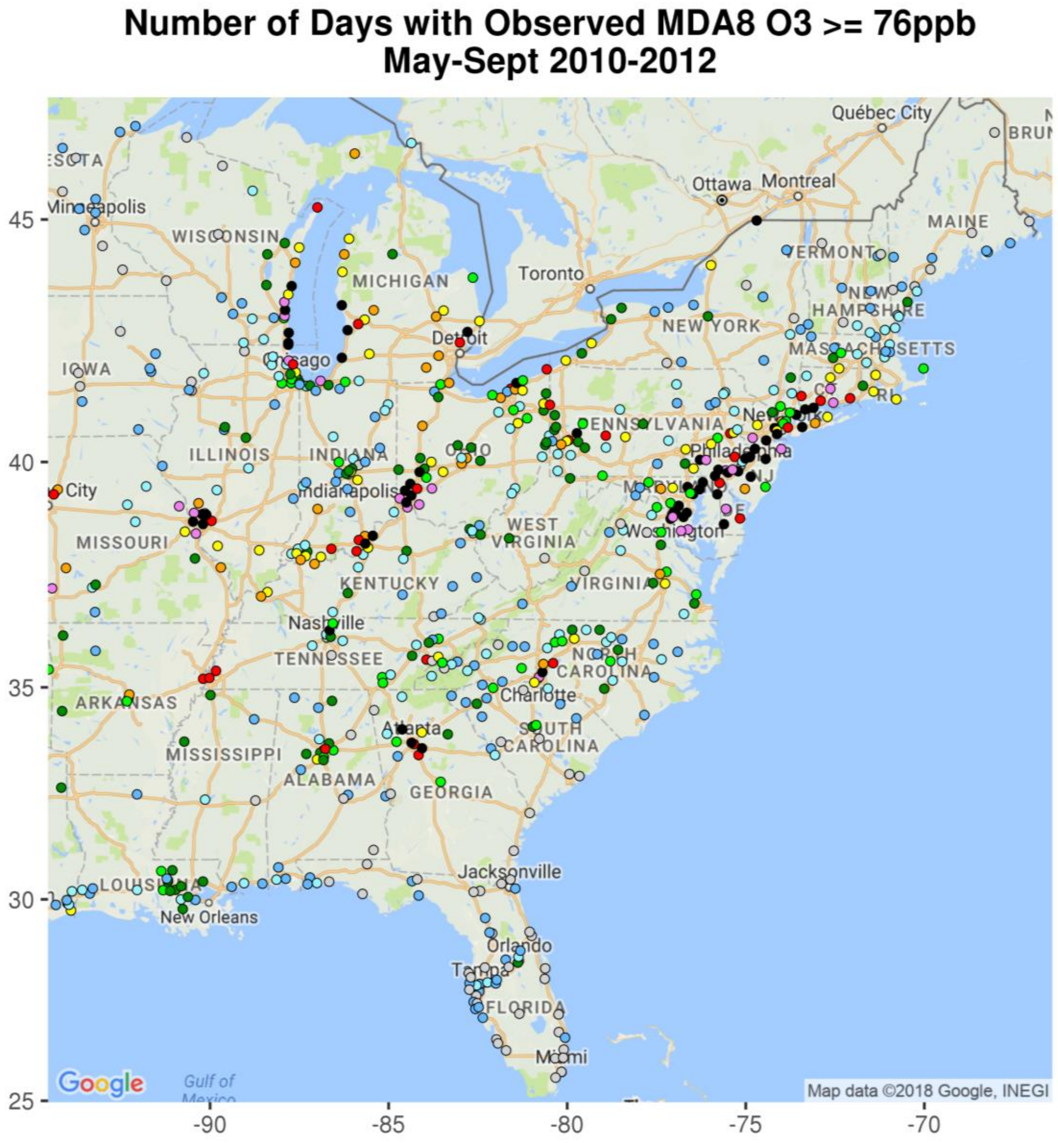
Preliminary Results

- From an Eastern US perspective, the current ozone levels appear to be more of a "local" problem (i.e., home state and adjacent neighboring states) compared to the larger regional ozone problem for that was evident back in 2010-2012.
- The magnitude of net ozone available for transport into the NE Corridor and the Lake Michigan area from more distant upwind states appears to have declined by 5 to 10 ppb based on 2010-2012 vs 2015-2017 avg ranked ozone values.
- Ozone levels have also declined substantially at the traditionally high ozone sites in the southern and central portions of the NE Corridor and at the traditionally high ozone sites along Lake Michigan
- Despite the ozone reductions at regional sites upwind of the NE Corridor and at sites in the central and southern Corridor, there is relatively little reduction between the 2010-2012 and the 2015-2017 avg ranked ozone at most of the sites in Coastal Connecticut.

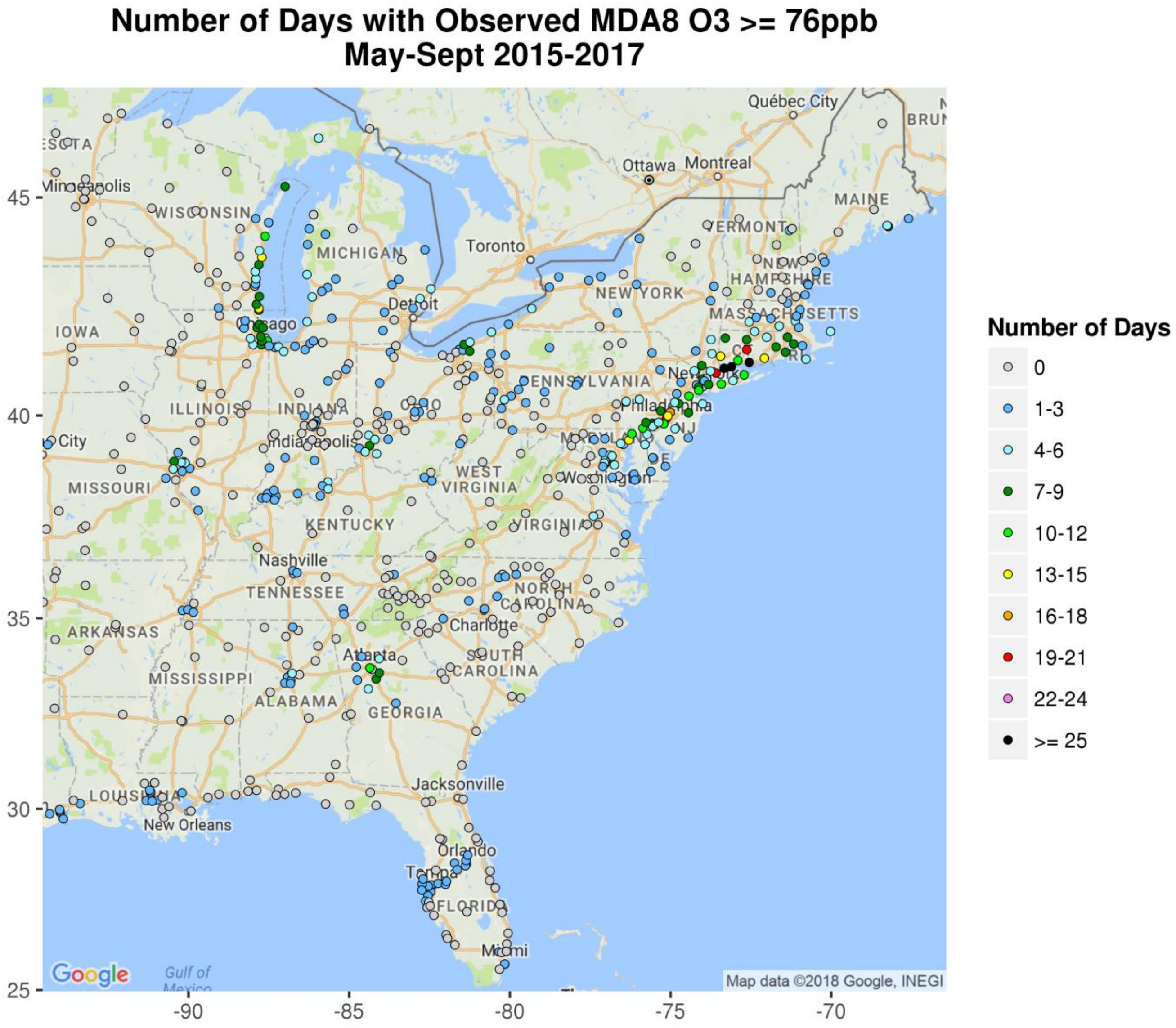
Regional Extent of Ozone Problem
2010-2012 vs 2015-2016

Metric: Number of total ozone season days that exceed 2008 and 2015 NAAQS

2010-2012 – 2008 NAAQS

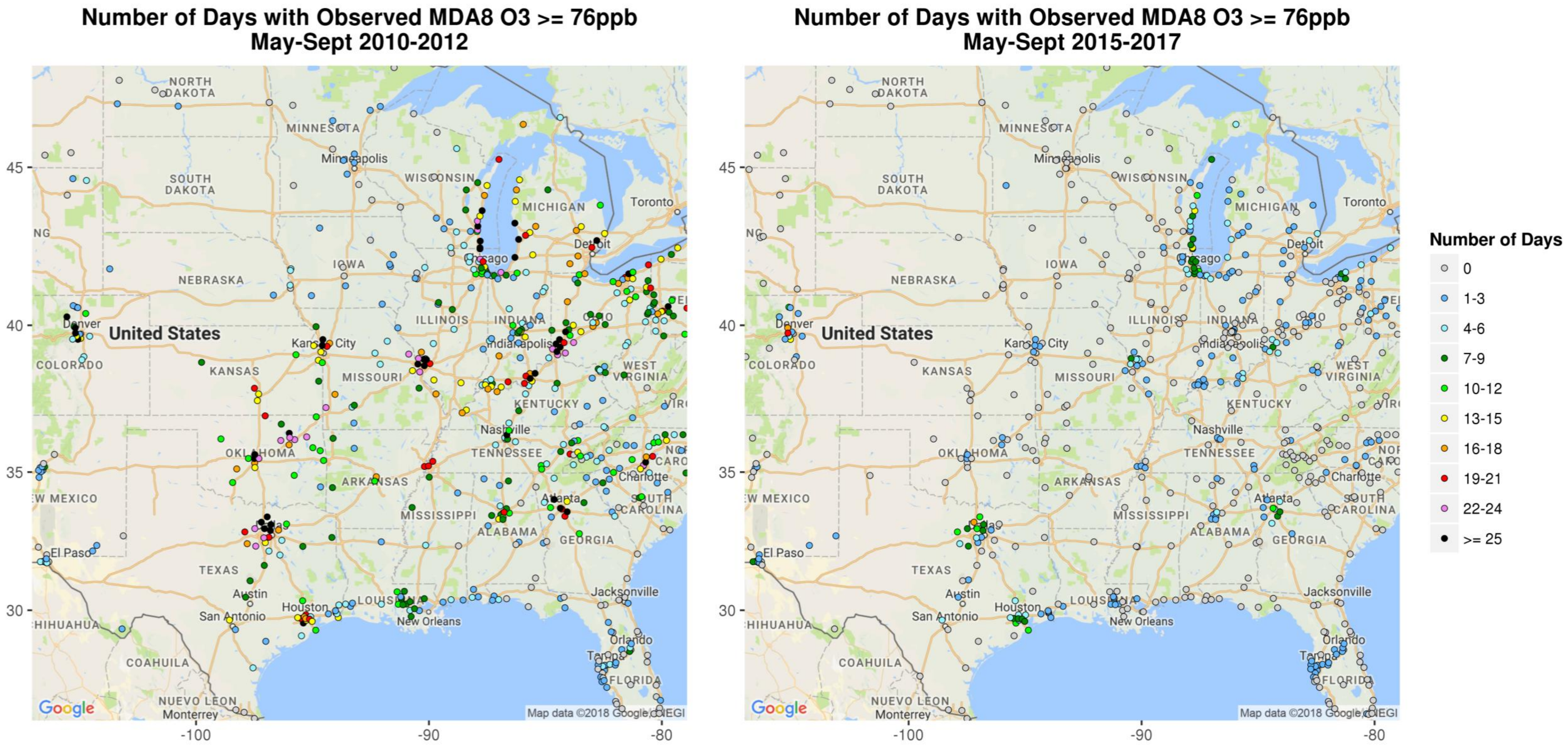


2015-2017 – 2008 NAAQS

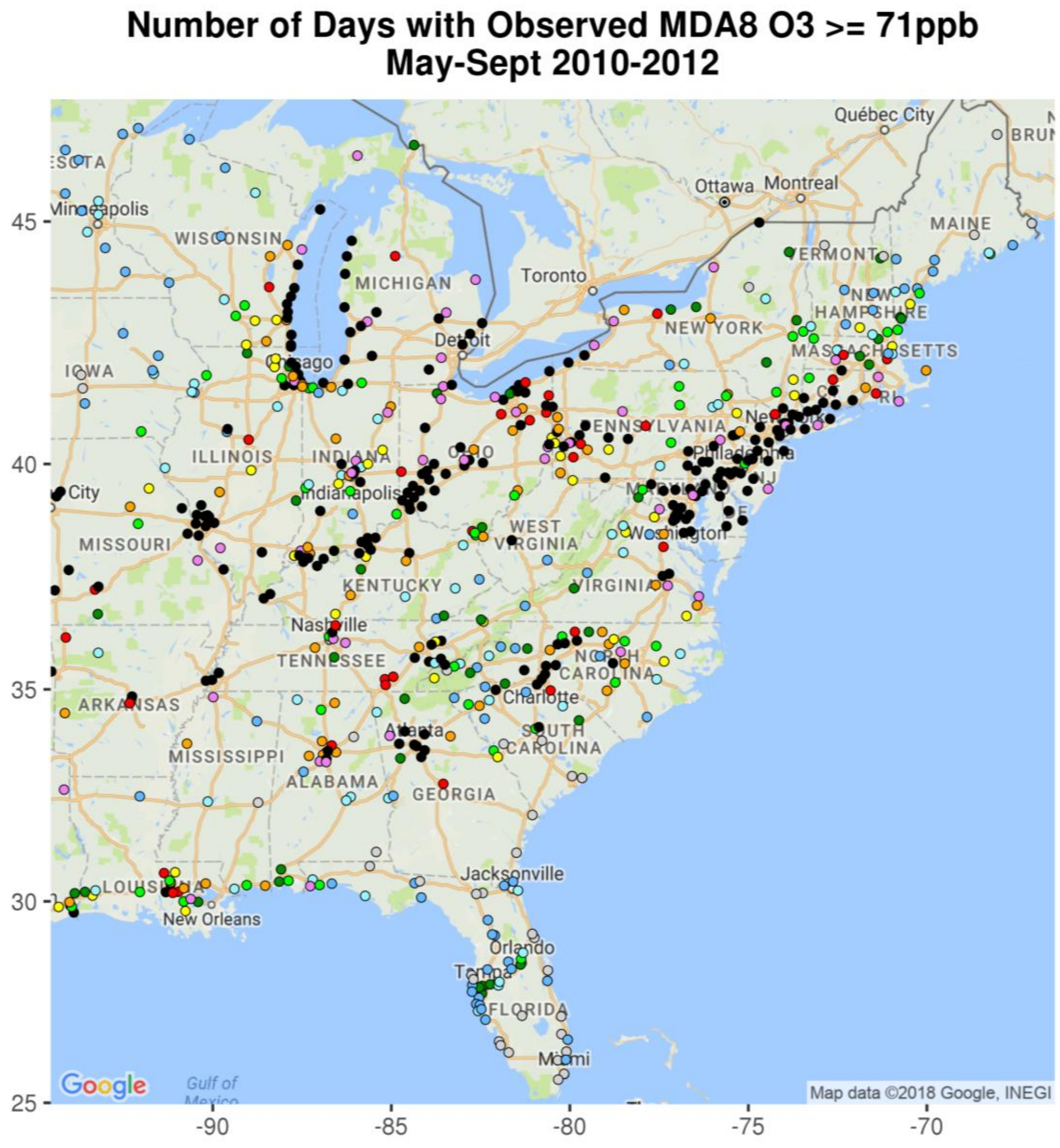


2010-2012 – 2008 NAAQS

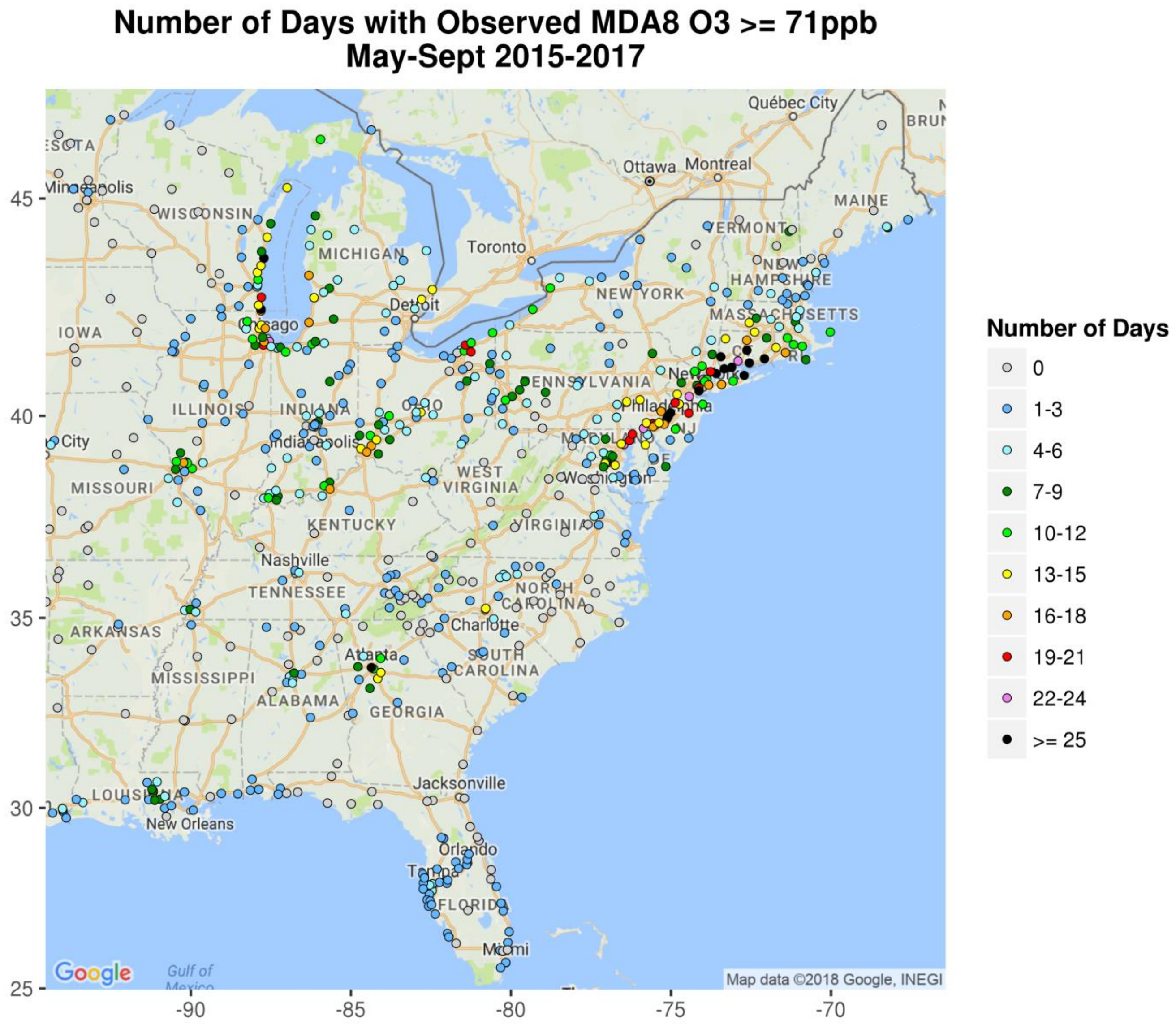
2015-2017 – 2008 NAAQS



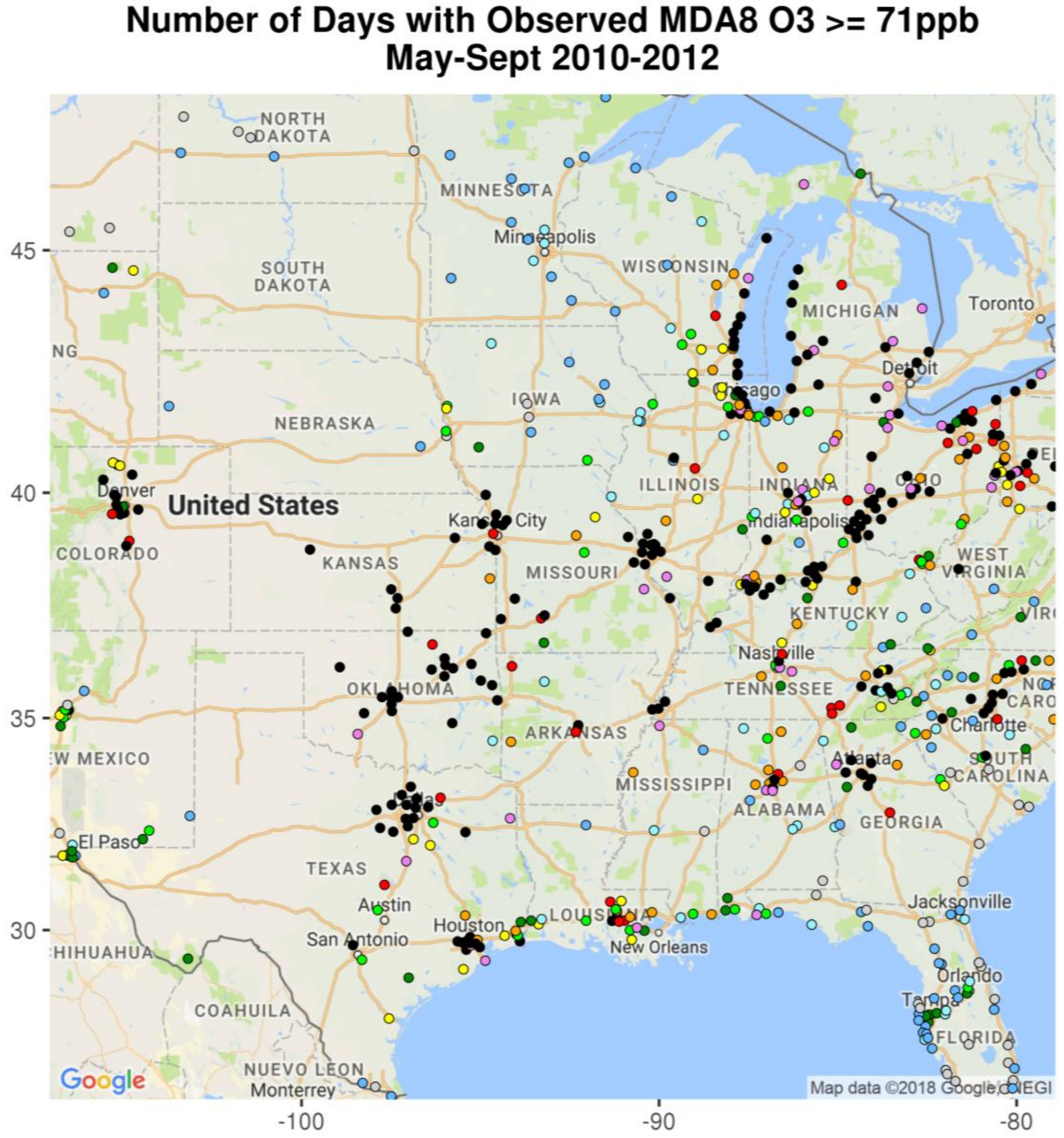
2010-2012 – 2015 NAAQS



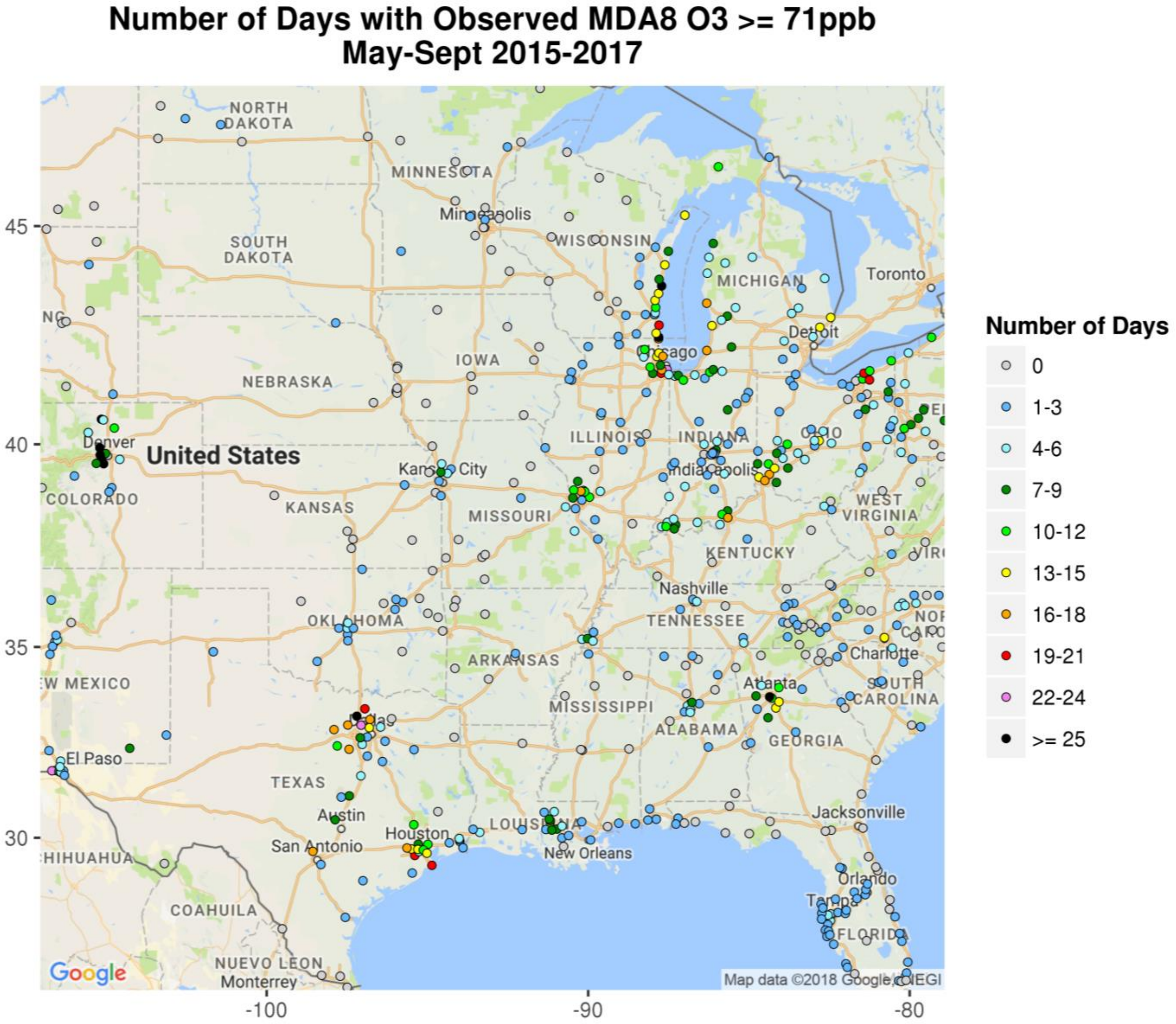
2015-2017 – 2015 NAAQS



2010-2012 – 2015 NAAQS



2015-2017 – 2015 NAAQS



Analysis of Trends in Ranked MDA8 Ozone Concentrations in the Northeast

Rural "Upwind" Sites

Kane Forest, PA 618 m (2,028ft)

Penn State U, PA 364 m (1,194 ft)

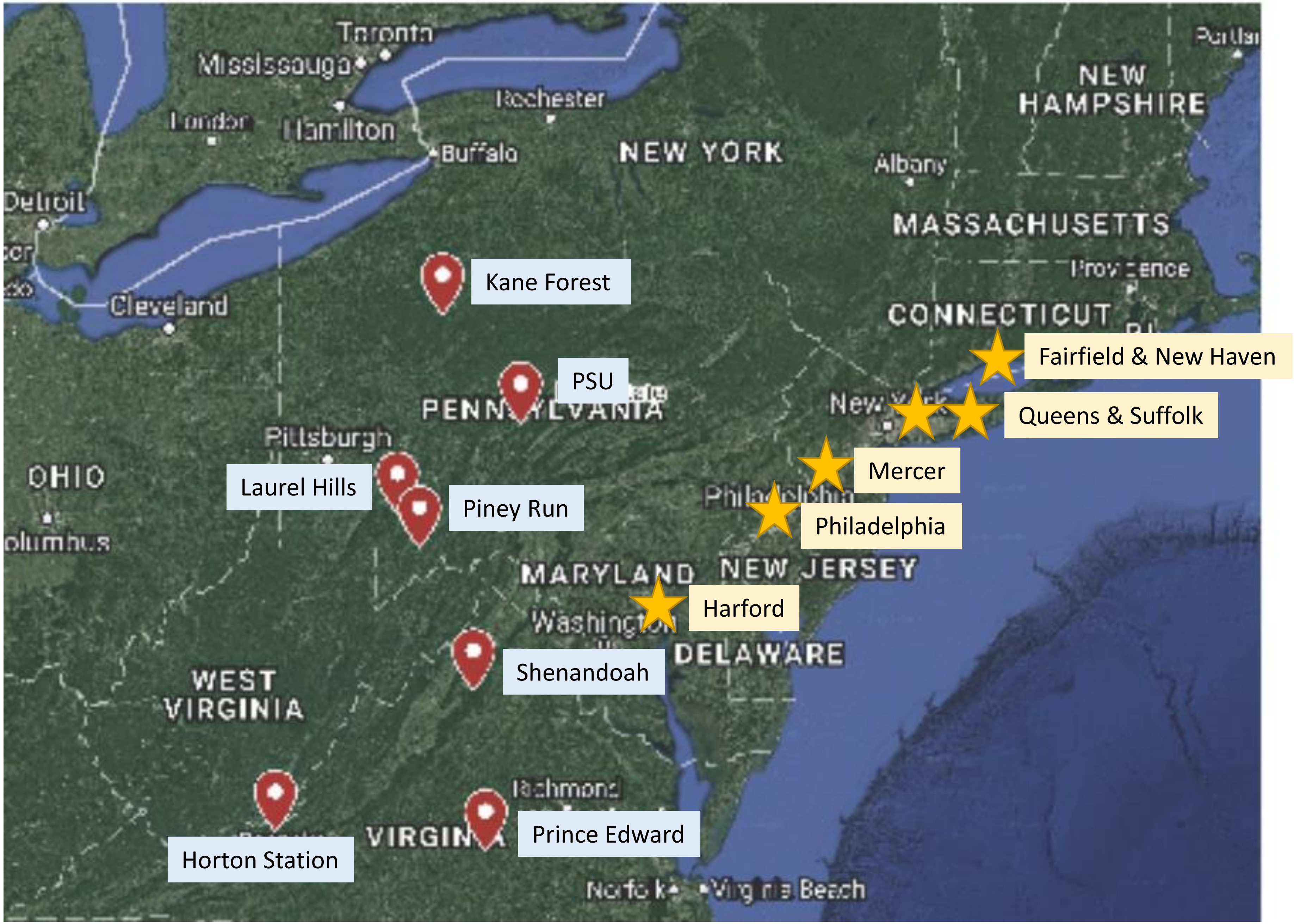
Laurel Hills, PA 615 m (2,018 ft)

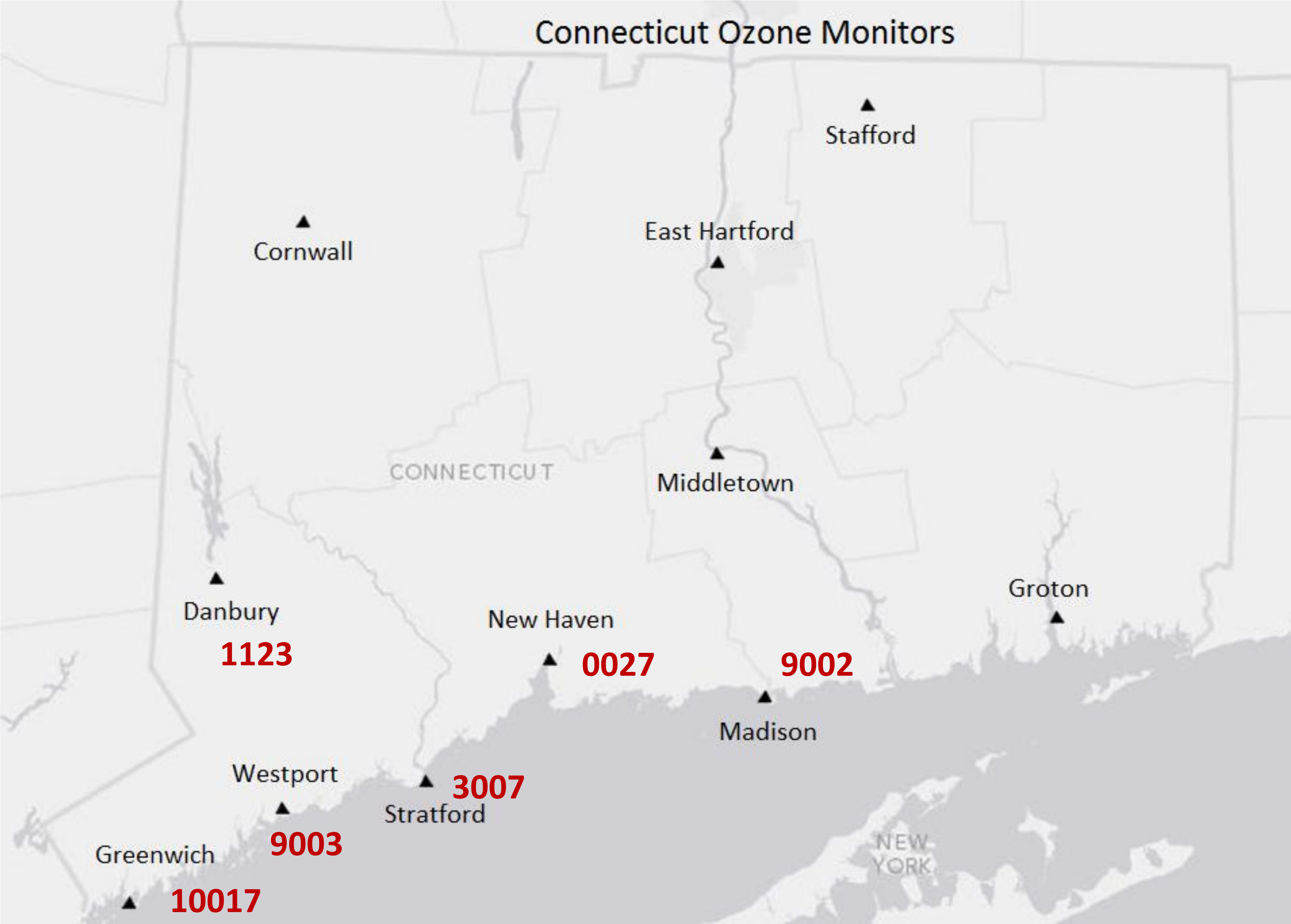
Piney Run, MD 777 m (2,549 ft)

Shenandoah, VA 1068 m (3,504 ft)

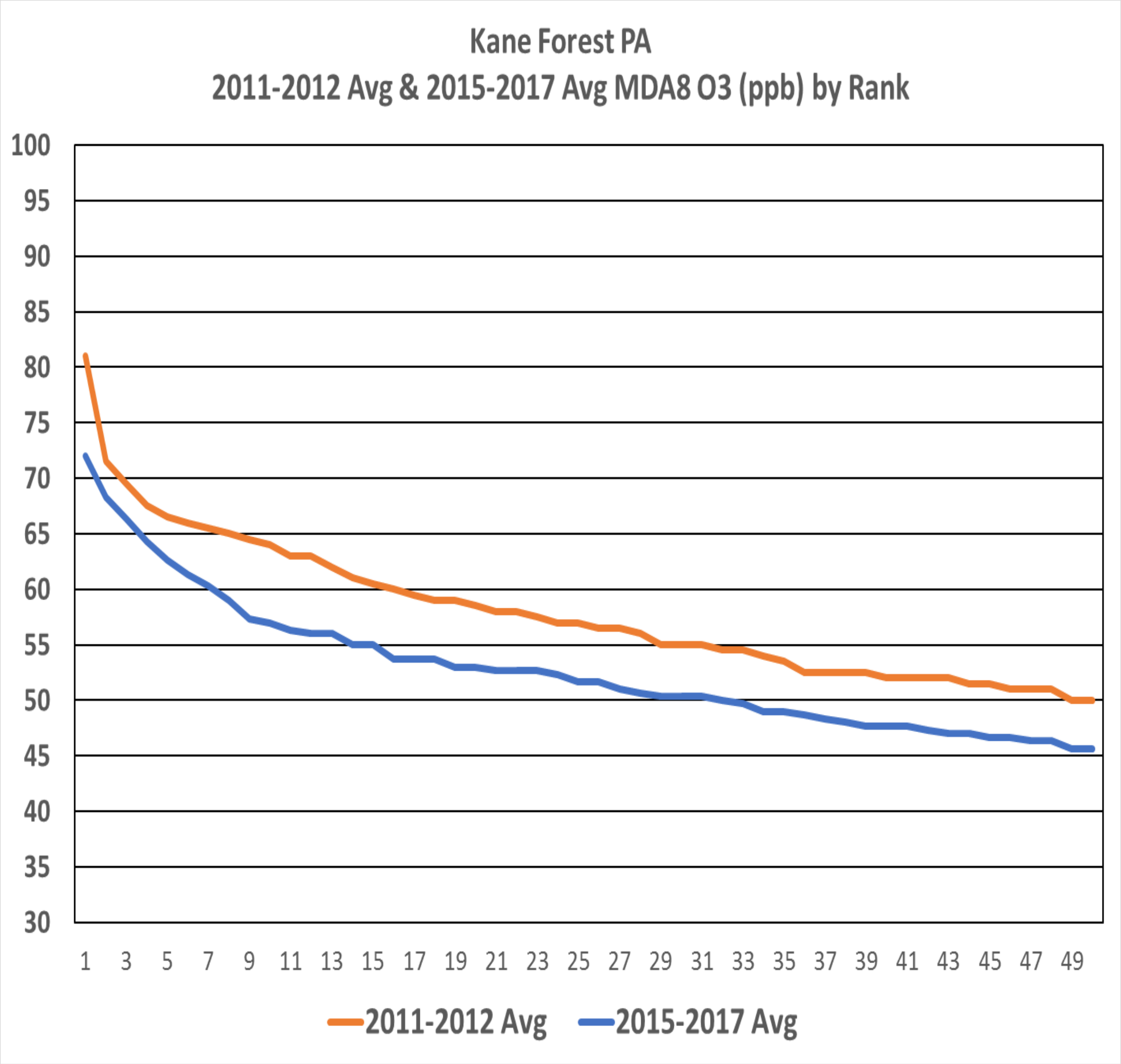
Horton Station, VA 920 m (3,018 ft)

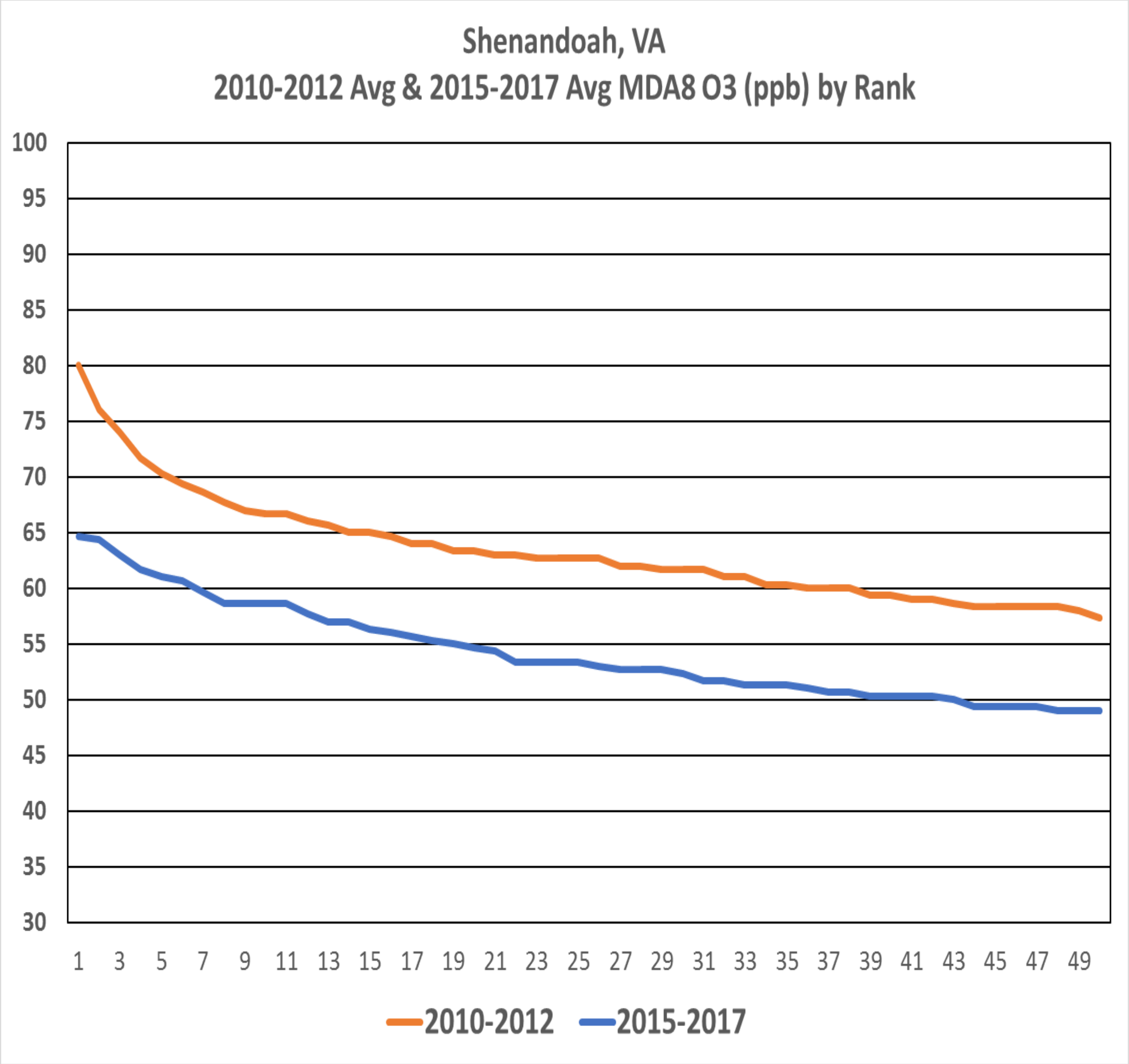
Prince Edward, VA 149 m (489 ft)



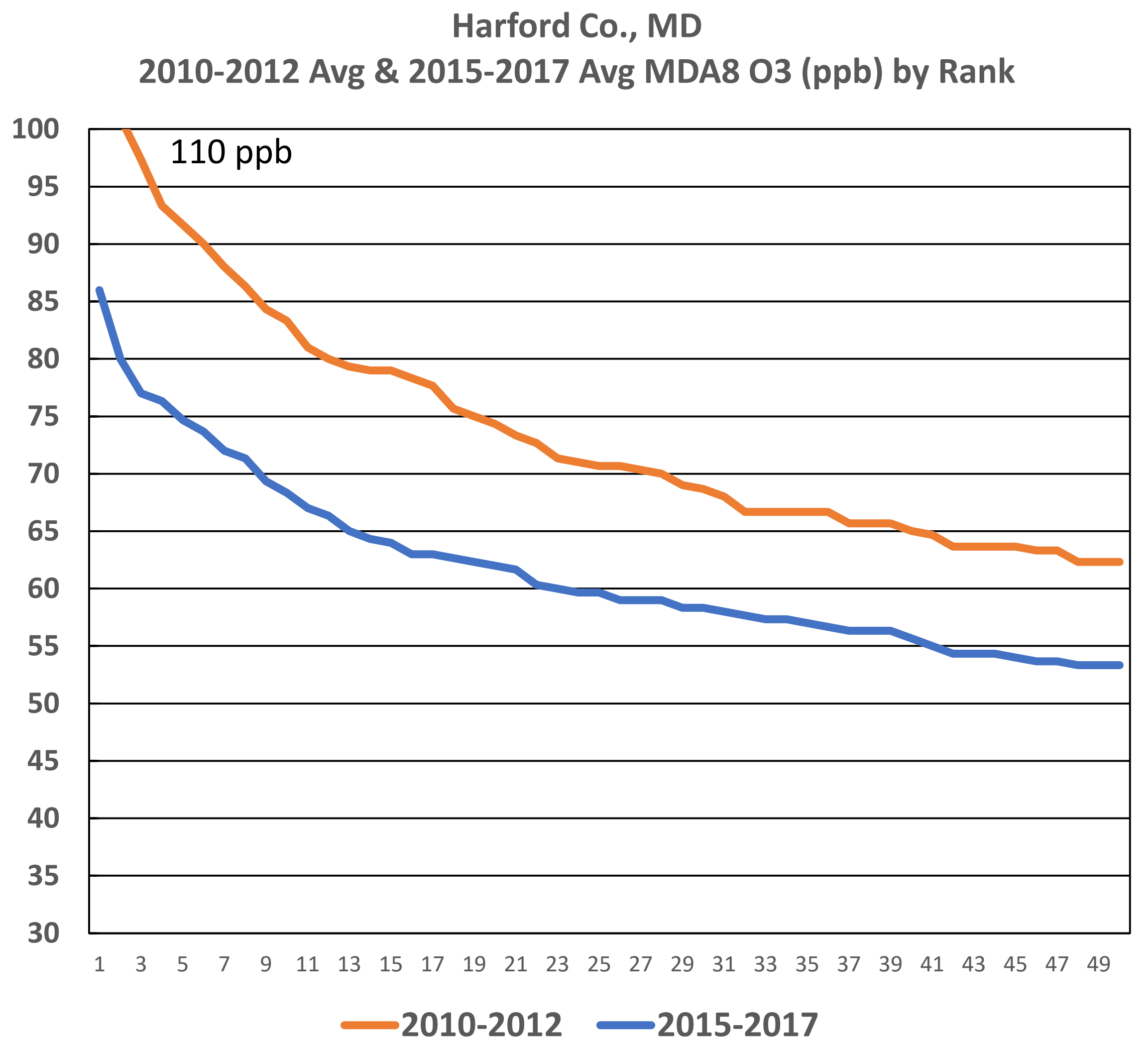

Connecticut Ozone Monitors
Stafford
Cornwall
East Hartford
CONNECTICUT
Middletown
Danbury
1123
New Haven
0027
9002
Groton
Madison
Westport
3007
Stratford
9003
Greenwich
10017
NEW YORK

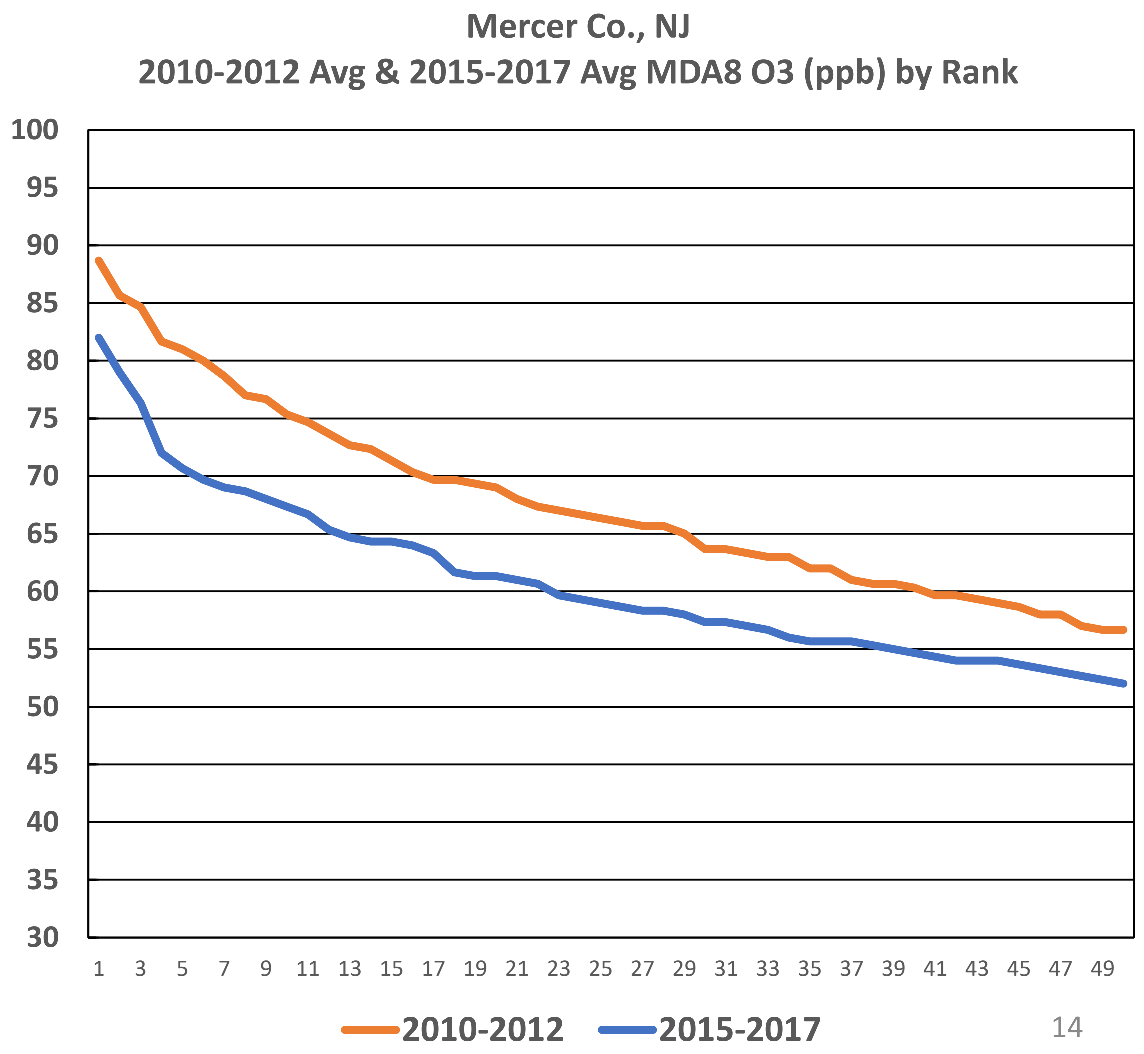
3-Year Avg Ranked MDA8 Ozone at Example Sites "Upwind of the NE Corridor"



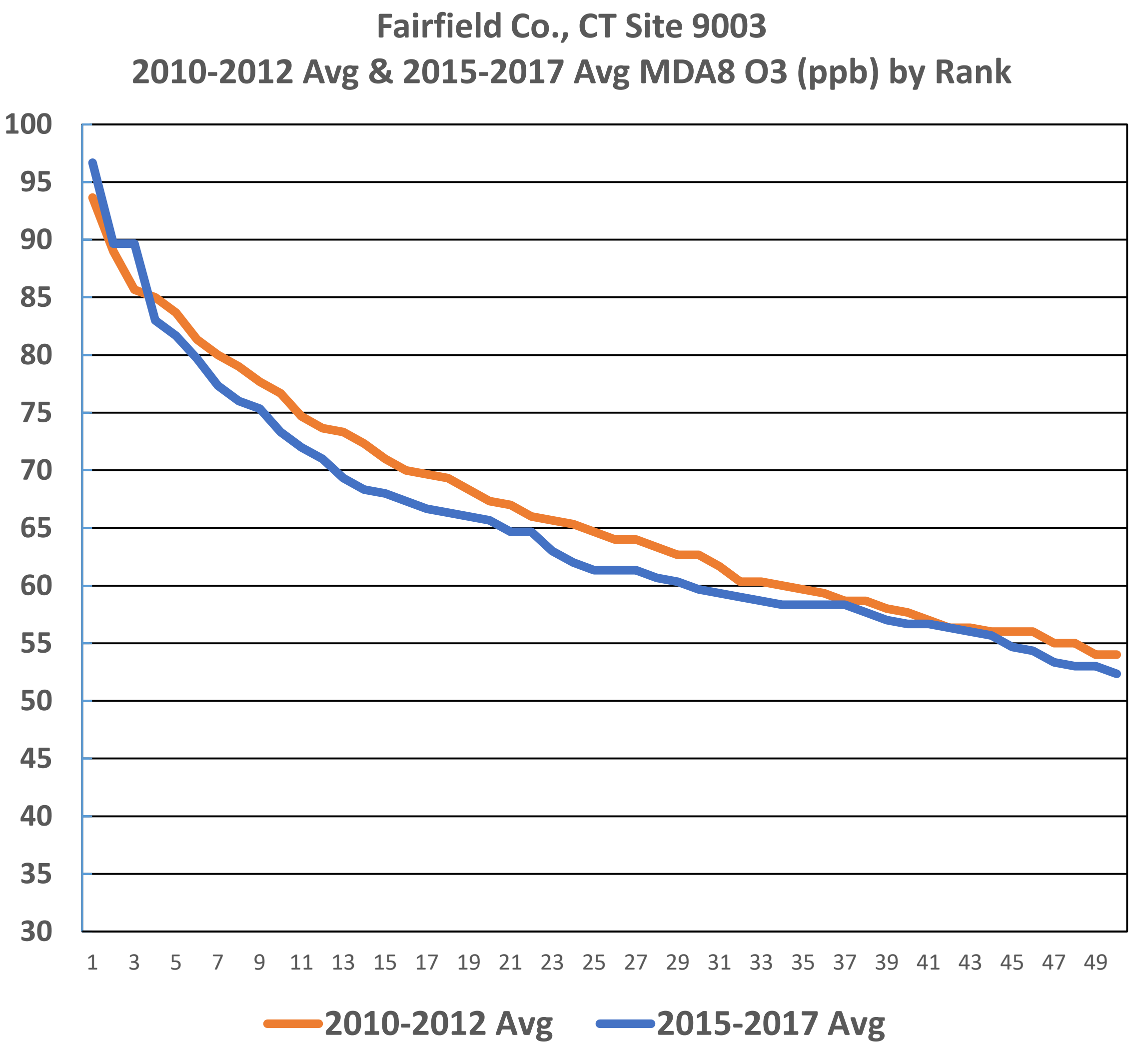


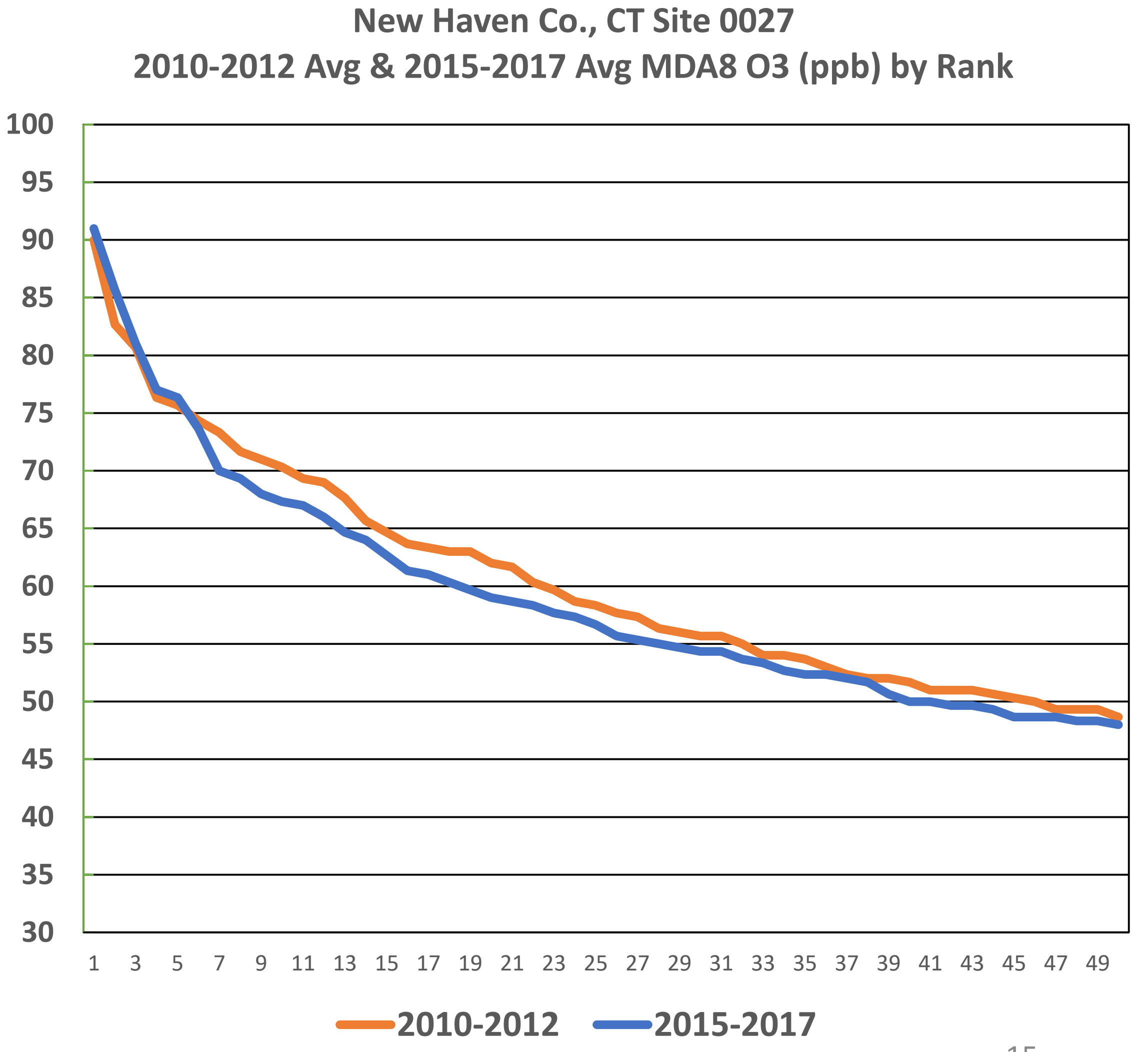
3-Year Avg Ranked MDA8 Ozone at Example High Ozone Sites in the Southern and Central Part of the NE Corridor





3-Year Avg Ranked MDA8 Ozone at Example High Ozone Sites in Coastal Connecticut





Reductions in O3 of ~5 to 10 ppb at sites upwind of the NE Corridor and along the Corridor up to NYC

Comparison of 2010-2012 Avg vs 2015-2017 Avg Ranked O3 (ppb)			
	Avg Change: Top 5 Days	**Avg Change: Days 6-15**	**Avg Change: Days 16-30**
Kane Forest, PA	-4.4	-6.1	-5.3
Penn State, PA	-8.5	-8.5	-6.5
Laurel Hills, PA	-5.8	-6.6	-5.6
Piney Run, MD	-11.7	-10.6	-10.0
Shenandoah, VA	-11.4	-8.4	-9.0
Horton Station, VA	-4.8	-5.2	-5.8
Prince Edward, VA	-8.1	-6.6	-6.8
Harford, MD	*-19.8*	*-14.9*	*-12.0*
Philadelphia, PA	*-6.6*	*-8.7*	*-7.9*
Mercer, NJ	*-8.3*	*-8.4*	*-7.1*
Queens, NY	*-7.5*	*-6.4*	-3.5
Suffolk, NY	*-12.8*	*-8.3*	*-5.1*
Danbury, CT 1123	*-6.8*	-1.8	-1.4
Greenwich, CT 1017	-2.1	-2.8	-3.9
Westport, CT 9003	0.7	-2.9	-2.6
Stratford, CT 3007	-0.2	-3.5	-2.0
New Haven, CT 0027	1.1	-2.4	-2.1
Madison, CT 9002	-4.0	-0.9	-1.4

Rural Upwind Sites

NE Corridor Sites

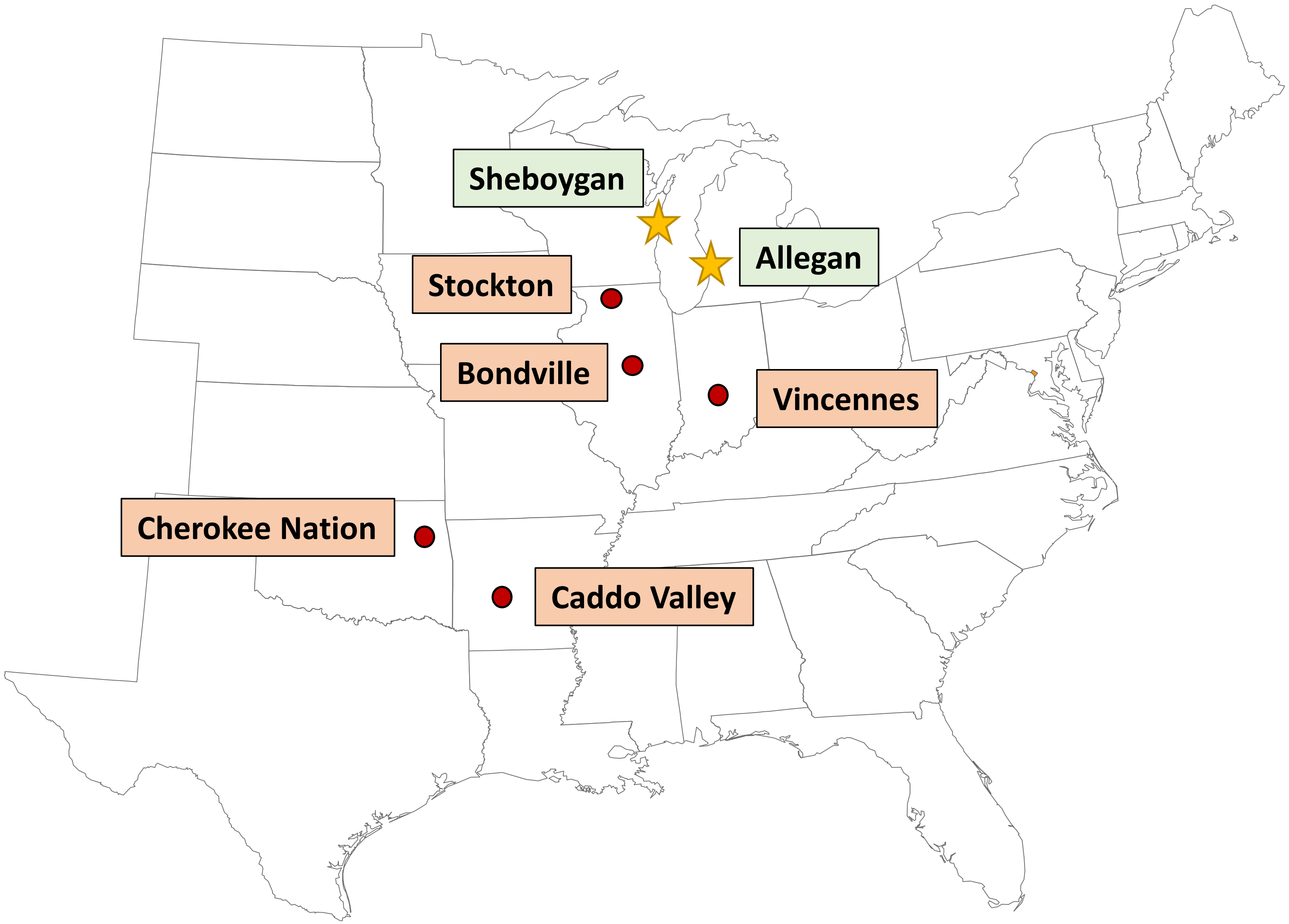
CT Coastal Sites

Reductions in O3 of less than 1 ppb to an increase of 1 ppb at sites in Coastal CT

Why Does High Ozone Persist at Sites in Coastal CT?

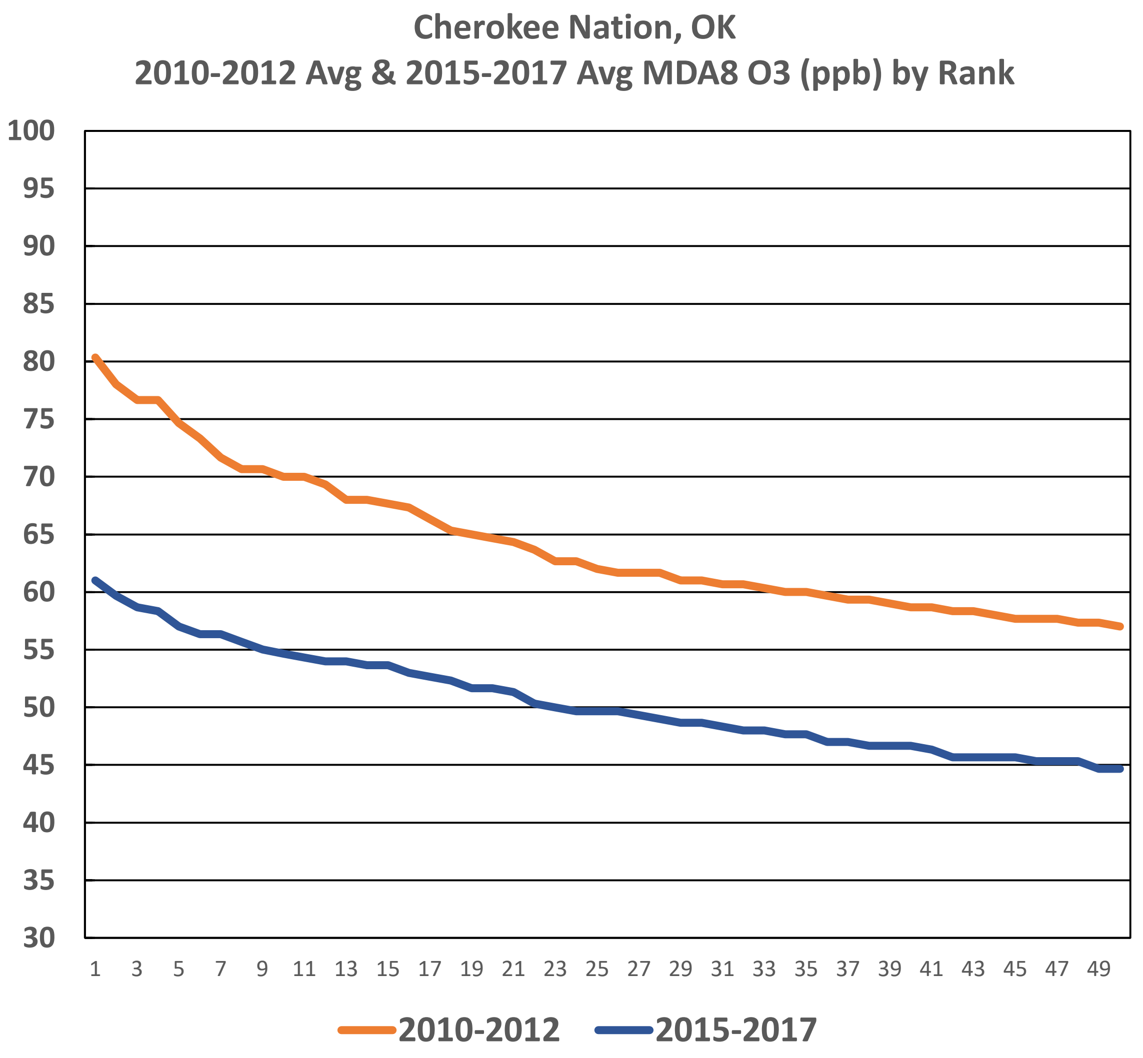
- Possible hypotheses include:
  - The core of the NYC urban area may still be "oxidant-limited" such that the substantial NOx reductions have yet to become fully beneficial
    - Downwind benefits of NOx reductions will become greater as the oxidant-limited area continues to shrink
  - Complex on-shore wind flows and limited vertical mixing associated with coastal meteorology contribute to the formation of high ozone levels in this area
  - The NYC area has higher mobile source emissions than other parts of the OTR, (on-road and non-road sources)
  - A unique mix of local (Tri-State area) contributions from other sources such as EGU, non-EGU point, nonpoint, and commercial marine.
  - "Behind the meter" generation (diesel generators that are not controlled and not in the emissions inventory that operate on hot summer days)
  - Peaking units (HEDD) within the OTR that may operate on mostly on high ozone days.
- Further exploration of the relative contribution from various source sectors within the NE Corridor and in nearby upwind states might also be informative.

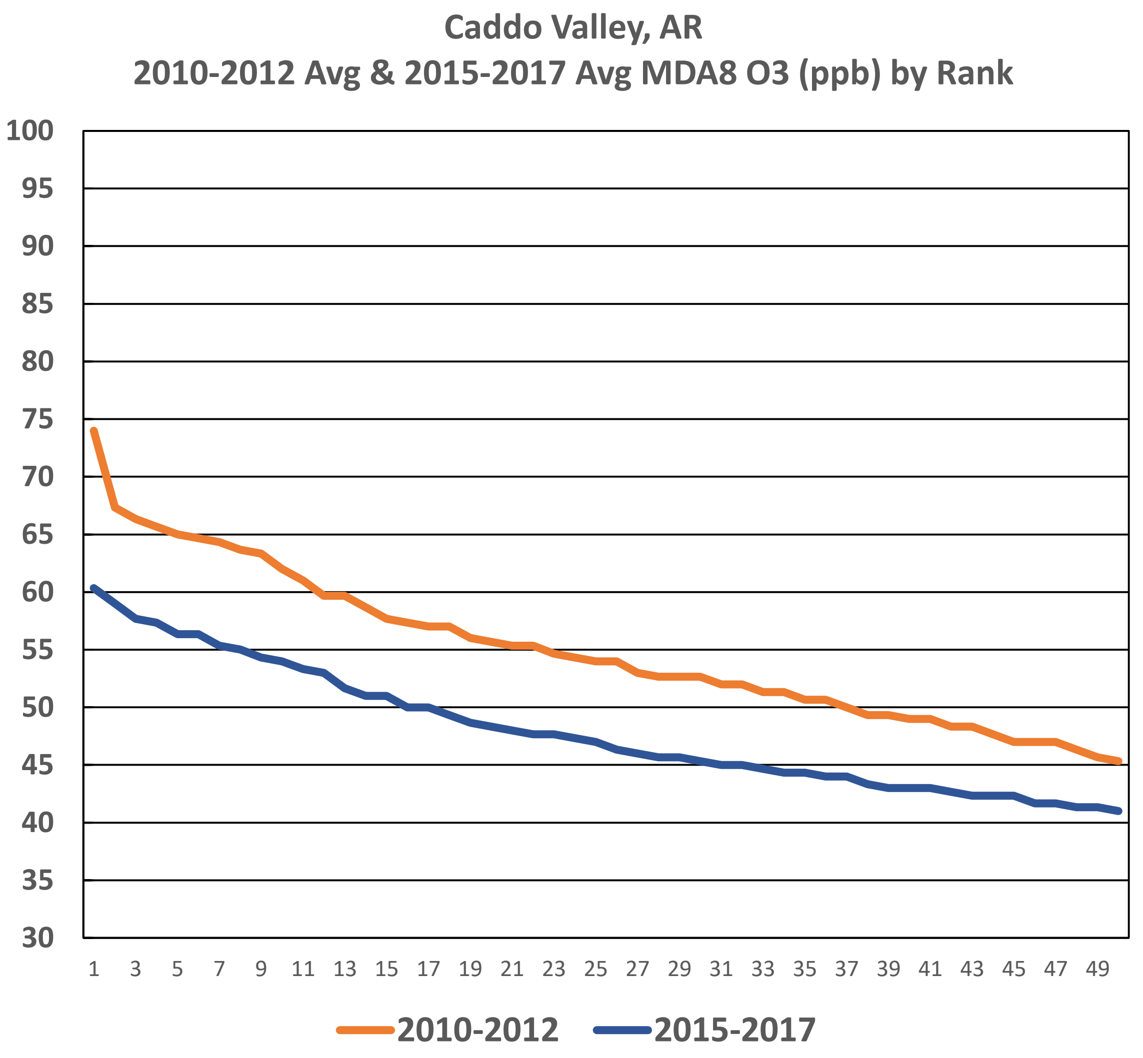
Analysis of Trends in Ranked MDA8 Ozone Concentrations in Portions of the Midwest and South



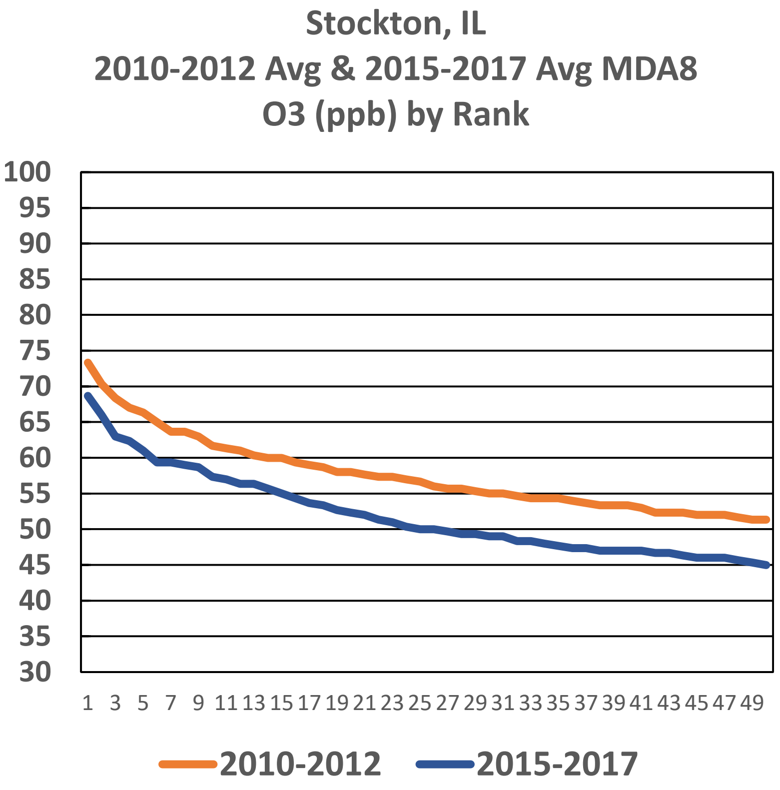
Sheboygan
Allegan
Stockton
Bondville
Vincennes
Cherokee Nation
Caddo Valley

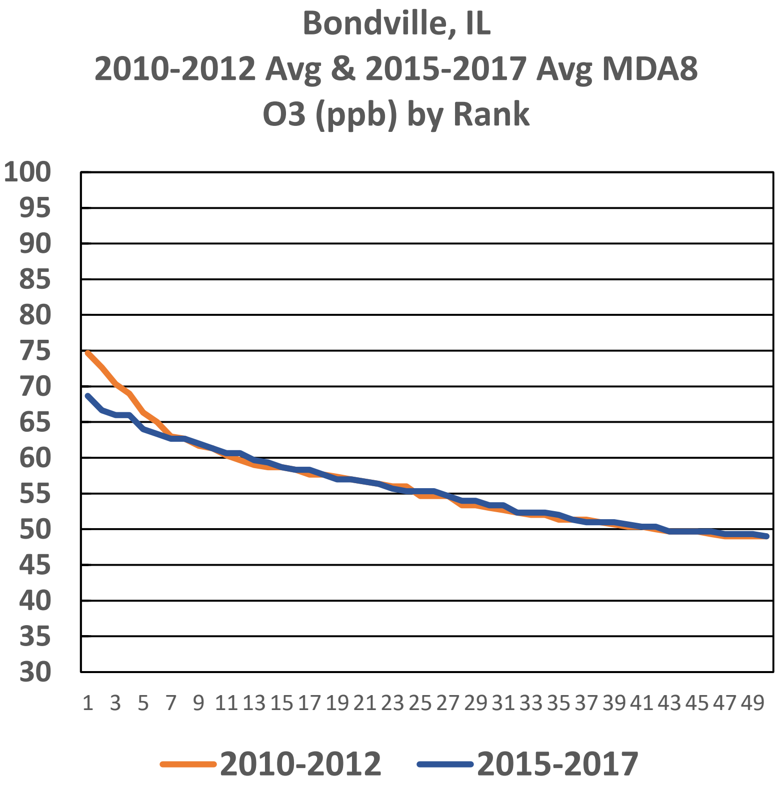
3-Year Avg Ranked MDA8 Ozone at Rural Sites Example Rural Sites in the South

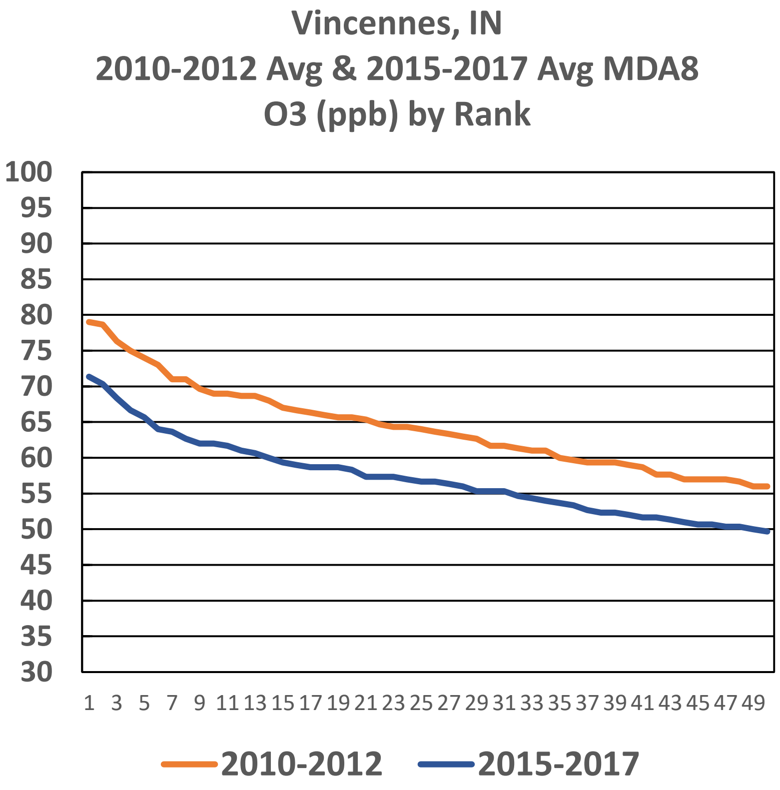


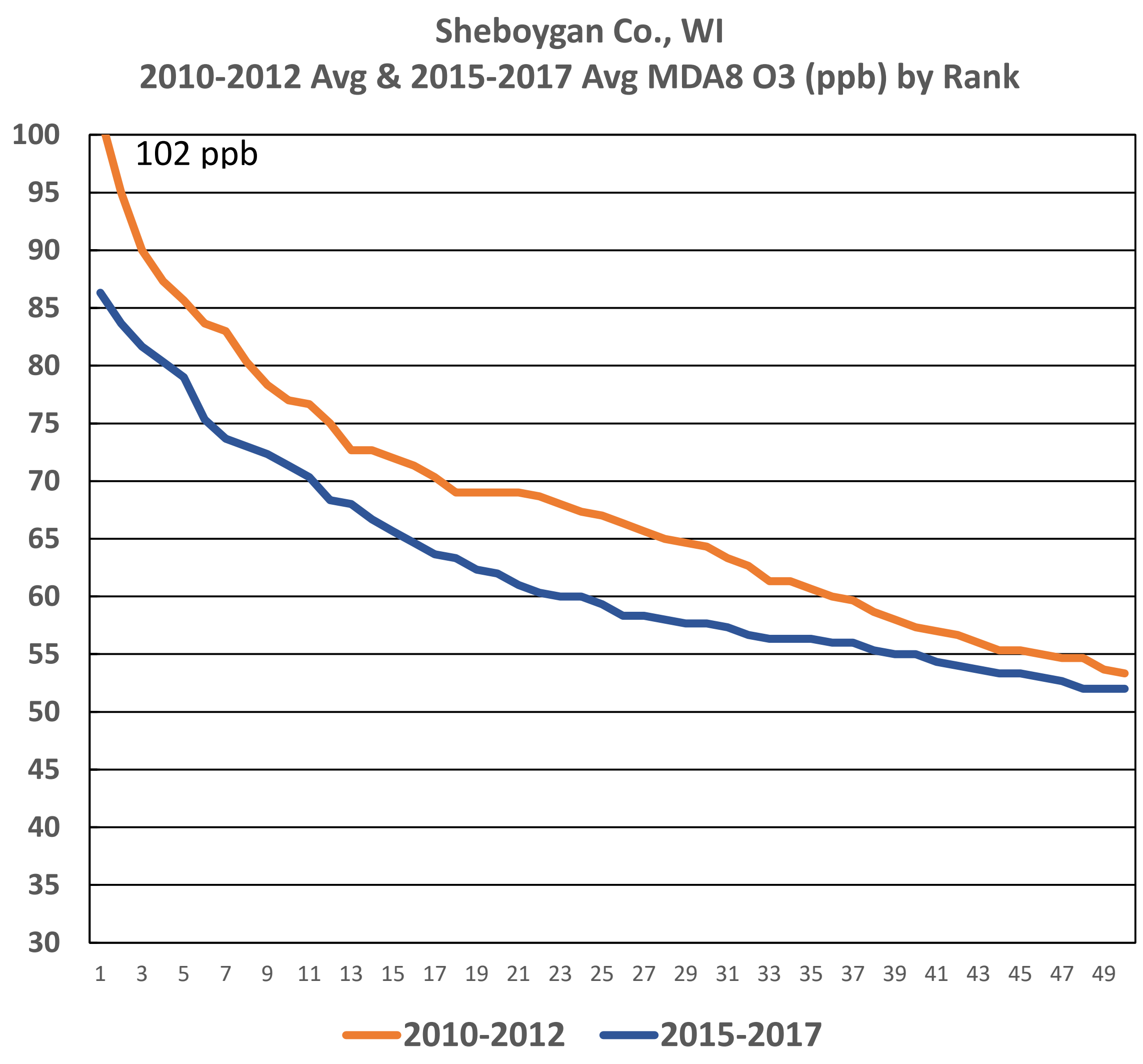


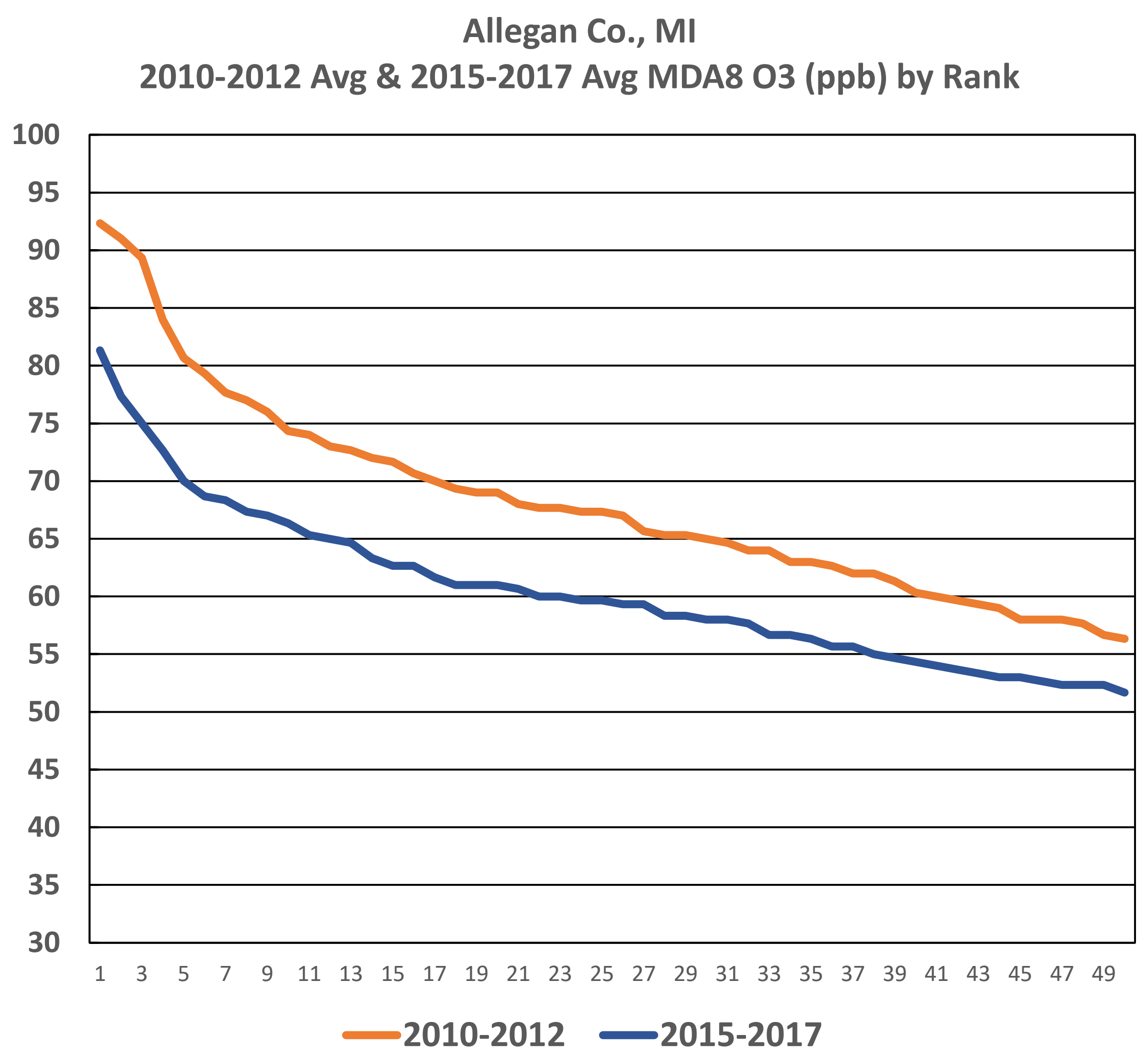
3-Year Avg Ranked MDA8 Ozone at Rural Sites
Example Rural Sites in the Midwest








Sheboygan Co., WI
2010-2012 Avg & 2015-2017 Avg MDA8 O3 (ppb) by Rank
102 ppb
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
2010-2012
2015-2017


Allegan Co., MI
2010-2012 Avg & 2015-2017 Avg MDA8 O3 (ppb) by Rank
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49
2010-2012
2015-2017

Next Steps

- Additional analyses of measured and modeled ozone data are planned to more fully understand the role of ozone transport and the relative importance of various source sectors to local ozone formation and transport.

- Collaborate with MJOs/states to help analyze issues which may be contributing to persistent nonattainment problems

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Appendix F

Comprehensive List of NO_X Controls for Indiana's EGUs and non-EGUs and Indiana's Annual NO_X Emissions for EGUs and non-EGUs

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STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Existing NOx Control	Projected Retrofit/Construction
A B Brown Generating Station	6137	1	Low NOx burners w/Overfire Air and Selective Catalytic Reduction	Shut Down in 2023
A B Brown Generating Station	6137	2	Low NOx burners w/Overfire Air and Selective Catalytic Reduction	Shut Down in 2023
A B Brown Generating Station	6137	3	Water Injection System	
A B Brown Generating Station	6137	4	Dry Low NOx Burner and Water injection	
Alcoa Allowance Management Inc	6705	4	Low NOx Burner and Selective Catalytic Reduction	
Anderson	7336	ACT1	Water injection system	No. 2 Fuel Oil (back-up fuel) and NG-fired (primary fuel)
Anderson	7336	ACT2	Water injection system	No. 2 Fuel Oil (back-up fuel) and NG-fired (primary fuel)
Anderson	7336	ACT3	None	No. 2 Fuel Oil (back-up fuel) and NG-fired (primary fuel)
Bailly Generating Station	995	10	None	NG-fired (simple cycle combustion turbine)
Bailly Generating Station	995	7	Overfire Air and Selective Catalytic Reduction (2008)	Shut Down in 2018
Bailly Generating Station	995	8	Overfire Air and Selective Catalytic Reduction	Shut Down in 2018
Broadway Avenue Generating St	1011	1	None	Shut Down in 2013
Broadway Avenue Generating St	1011	2	Water Injection System	NG-fired
Cayuga	1001	1	Low NOx Burner Technology w/ Separated OFA	Selective Catalytic Reduction scheduled to be installed by 2015 per
Cayuga	1001	2	Low NOx Burner Technology w/ Separated OFA	Selective Catalytic Reduction scheduled to be installed by 2015 per
Cayuga	1001	4	Hybrid Burners/Water Injection	Shut Down in 2009
Clifty Creek	983	1	Overfire Air and Selective Catalytic Reduction	
Clifty Creek	983	2	Overfire Air and Selective Catalytic Reduction	
Clifty Creek	983	3	Overfire Air and Selective Catalytic Reduction	
Clifty Creek	983	4	Overfire Air and Selective Catalytic Reduction	
Clifty Creek	983	5	Overfire Air and Selective Catalytic Reduction	
Clifty Creek	983	6	Overfire Air	
Connersville Peaking Station	1002	1A	None	Furel Oil-fired
Connersville Peaking Station	1002	1B	None	Furel Oil-fired
Connersville Peaking Station	1002	2A	None	Furel Oil-fired
Connersville Peaking Station	1002	2B	None	Furel Oil-fired
Dean H Mitchell Generating Stat	996	11	Low NOx Burners	Shut Down in 2010
Dean H Mitchell Generating Stat	996	4	None	Shut Down in 2010
Dean H Mitchell Generating Stat	996	5	None	Shut Down in 2010
Dean H Mitchell Generating Stat	996	6	Low NOx Burners	Shut Down in 2010
Duke Vermillion Generating Stat	55111	1	Low NOx Burners	
Duke Vermillion Generating Stat	55111	2	Low NOx Burners	
Duke Vermillion Generating Stat	55111	3	Low NOx Burners	
Duke Vermillion Generating Stat	55111	4	Low NOx Burners	
Duke Vermillion Generating Stat	55111	5	Low NOx Burners	
Duke Vermillion Generating Stat	55111	6	Low NOx Burners	
Duke Vermillion Generating Stat	55111	7	Low NOx Burners	
Duke Vermillion Generating Stat	55111	8	Low NOx Burners	

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Existing NOx Control	Projected Retrofit/Construction
Edwardsport Generating Station	1004	6-1	None	Shut Down Prior to 2008
Edwardsport Generating Station	1004	7-1	None	Shut Down in 2010
Edwardsport Generating Station	1004	7-2	None	Shut Down in 2012
Edwardsport Generating Station	1004	8-1	None	Shut Down in 2012
Edwardsport Generating Station	1004	CTHRG1	Good Combustion Practices	NG-fired
Edwardsport Generating Station	1004	CTHRG2	Good Combustion Practices	NG-fired
F B Culley Generating Station	1012	1	None	Shut Down in 2006/Repower or shut down by 2006 as part of Consent Decree IP99-1692 C-M/F
F B Culley Generating Station	1012	2	Low NOx Burner Technology (Dry Bottom only) and Selective Catalytic Reduction	Shut Down in 2023
F B Culley Generating Station	1012	3	Low NOx Burner Technology (Dry Bottom only) and Selective Catalytic Reduction	
Frank E Ratts	1043	1SG1	Low NOx Burner Technology (Dry Bottom only) and Selective Catalytic Reduction	Shut Down in 2015
Frank E Ratts	1043	2SG1	Low NOx Burner Technology (Dry Bottom only) and Selective Catalytic Reduction	Shut Down in 2014
Georgetown Substation	7759	GT1	Dry Low NOx Burners	
Georgetown Substation	7759	GT2	Dry Low NOx Burners	
Georgetown Substation	7759	GT3	Dry Low NOx Burners	
Georgetown Substation	7759	GT4	Dry Low NOx Burners	
Gibson	6113	1	Low NOx Burner Technology w/ Overfire Air and Selective Catalytic Reduction	
Gibson	6113	2	Low NOx Burner Technology w/ Overfire Air and Selective Catalytic Reduction	
Gibson	6113	3	Low NOx Burner Technology w/ Overfire Air and Selective Catalytic Reduction	
Gibson	6113	4	Low NOx Burner Technology w/ Overfire Air and Selective Catalytic Reduction	
Gibson	6113	5	Low NOx Burner Technology w/ Overfire Air and Selective Catalytic Reduction	
Harding Street Station (EW Stout	990	10	None	Shutdown 2011
Harding Street Station (EW Stout	990	50	Low NOx Burner Technology w/ Separated OFA and Selective Non-catalytic Reduction	Convert to Natural Gas per SSM 33140
Harding Street Station (EW Stout	990	60	Low NOx Burner Technology w/ Separated OFA and Selective Non-catalytic Reduction	Convert to Natural Gas per SSM 33140
Harding Street Station (EW Stout	990	70	Low NOx Burner Technology w/ Closed-coupled/Separated OFA and Selective Catalytic Reduction	Convert to Natural Gas per SSM 35518
Harding Street Station (EW Stout	990	9	None	Shutdown 2011
Harding Street Station (EW Stout	990	GT4	Water Injection System	Distillate oil or NG-fired
Harding Street Station (EW Stout	990	GT5	Water Injection System	Distillate oil or NG-fired
Harding Street Station (EW Stout	990	GT6	Dry Low Nox Burners	
Henry County Generating Station	7763	1	Water Injection System	NG-fired

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Existing NOx Control	Projected Retrofit/Construction
Henry County Generating Station	7763	2	Water Injection System	NG-fired
Henry County Generating Station	7763	3	Water Injection System	NG-fired
Hoosier Energy Lawrence Co Sta	7948	1	Water Injection System	NG-fired
Hoosier Energy Lawrence Co Sta	7948	2	Water Injection System	NG-fired
Hoosier Energy Lawrence Co Sta	7948	3	Water Injection System	NG-fired
Hoosier Energy Lawrence Co Sta	7948	4	Water Injection System	NG-fired
Hoosier Energy Lawrence Co Sta	7948	5	Water Injection System	NG-fired
Hoosier Energy Lawrence Co Sta	7948	6	Water Injection System	NG-fired
Eagle Valley Generating Station	991	1	Low Combustion Burner and Selective Catalytic Reduction System	Shut Down in 2011
Eagle Valley Generating Station	991	2	Low Combustion Burner and Selective Catalytic Reduction System	Shut Down in 2011
Eagle Valley Generating Station	991	3	None	Shut Down in 2015
Eagle Valley Generating Station	991	4	Low NOx Burner with Separated Overfire Air	Shut Down in 2016
Eagle Valley Generating Station	991	5	Low NOx Burner with Separated Overfire Air	Shut Down in 2016
Eagle Valley Generating Station	991	6	Low NOx Burner with Closed-coupled Overfire Air	Shut Down in 2016
Lawrenceburg Energy Facility	55502	1	Low NOx Burner and Selective Catalytic Reduction System	
Lawrenceburg Energy Facility	55502	2	Low NOx Burner and Selective Catalytic Reduction System	
Lawrenceburg Energy Facility	55502	3	Low NOx Burner and Selective Catalytic Reduction System	
Lawrenceburg Energy Facility	55502	4	Low NOx Burner and Selective Catalytic Reduction System	
Merom	6213	1SG1	Low NOx Burner Technology w/ Overfire Air and Selective Catalytic	
Merom	6213	2SG1	Low NOx Burner Technology w/ Overfire Air and Selective Catalytic	
Michigan City Generating Station	997	12	Overfire Air and Selective Catalytic Reduction	
Michigan City Generating Station	997	4	None	Shutdown prior to 2008
Michigan City Generating Station	997	5	None	Shutdown prior to 2008
Michigan City Generating Station	997	6	None	Shutdown prior to 2008
Montpelier Electric Gen Station	55229	G1CT1	Water Injection System	NG-fired with No. 2 Fuel Oil backup
Montpelier Electric Gen Station	55229	G1CT2	Water Injection System	NG-fired with No. 2 Fuel Oil backup
Montpelier Electric Gen Station	55229	G2CT1	Water Injection System	NG-fired with No. 2 Fuel Oil backup
Montpelier Electric Gen Station	55229	G2CT2	Water Injection System	NG-fired with No. 2 Fuel Oil backup
Montpelier Electric Gen Station	55229	G3CT1	Water Injection System	NG-fired with No. 2 Fuel Oil backup
Montpelier Electric Gen Station	55229	G3CT2	Water Injection System	NG-fired with No. 2 Fuel Oil backup
Montpelier Electric Gen Station	55229	G4CT1	Water Injection System	NG-fired with No. 2 Fuel Oil backup
Montpelier Electric Gen Station	55229	G4CT2	Water Injection System	NG-fired with No. 2 Fuel Oil backup

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Existing NOx Control	Projected Retrofit/Construction
Noblesville	1007	1	None	Shut Down in 2003
Noblesville	1007	2	None	Shut Down in 2003
Noblesville	1007	3	None	Shut Down in 2003
Noblesville	1007	CT3	Dry Low NOx Burners and Selective Catalytic Reduction	
Noblesville	1007	CT4	Dry Low NOx Burners and Selective Catalytic Reduction	
Noblesville	1007	CT5	Dry Low NOx Burners and Selective Catalytic Reduction	
Petersburg Generating Station	994	1	Low NOx Burner Technology w/ Closed-coupled/Separated OFA	
Petersburg Generating Station	994	2	Low NOx Burner Technology w/ Closed-coupled/Separated OFA Selective Catalytic Reduction	
Petersburg Generating Station	994	3	Low NOx Burner Technology w/ Closed-coupled OFA and Selective Catalytic Reduction	
Petersburg Generating Station	994	4	Low NOx Burner Technology	
R Gallagher	1008	1	Low NOx Burner Technology	Shut Down in 2012
R Gallagher	1008	2	Low NOx Burner Technology	Shut Down in 2022
R Gallagher	1008	3	Low NOx Burner Technology	Shut Down in 2012
R Gallagher	1008	4	Low NOx Burner Technology	Shut Down in 2022
R M Schahfer Generating Station	6085	14	Overfire Air and Selective Catalytic Reduction	Shut Down in 2023
R M Schahfer Generating Station	6085	15	Low NOx Burner Technology (Dry Bottom only) and SNCR	Shut Down in 2023
R M Schahfer Generating Station	6085	16A	Water Injection System	NG-fired
R M Schahfer Generating Station	6085	16B	Water Injection System	NG-fired
R M Schahfer Generating Station	6085	17	Low NOx Burner Technology w/ Closed-coupled/Separated OFA	
R M Schahfer Generating Station	6085	18	Low NOx Burner Technology w/ Closed-coupled OFA	
Richmond (IN)	7335	RCT1	Water Injection System	NG-fired with No. 2 Fuel Oil backup
Richmond (IN)	7335	RCT2	Water Injection System	NG-fired with No. 2 Fuel Oil backup
Rockport	6166	MB1	Low NOx Burner Technology (Dry Botton only) w/ Overfire Air	Selective Catalytic Reduction scheduled permitted in 2015 (began
Rockport	6166	MB2	Low NOx Burner Technology (Dry Botton only) w/ Overfire Air	Selective Catalytic Reduction scheduled to be installed by 12/31/19 per consent decree (permitted in
St. Josph Energy Center		CTG01A	Dry Low NOx Burners and Selective Catalytic Reduction	Title V New Source Construction Permit Issued 2012
St. Josph Energy Center		CTG01B	Dry Low NOx Burners and Selective Catalytic Reduction	Title V New Source Construction Permit Issued 2012
St. Josph Energy Center		CTG02A	Dry Low NOx Burners and Selective Catalytic Reduction	Title V New Source Construction Permit Issued 2012
St. Josph Energy Center		CTG02B	Dry Low NOx Burners and Selective Catalytic Reduction	Title V New Source Construction Permit Issued 2012
State Line	981	3	None	Shut Down in 2012
State Line	981	4	None	Shut Down in 2012

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ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Existing NOx Control	Projected Retrofit/Construction
Sugar Creek Generating Station	55364	CT11	Dry Low NOx Burners and Selective Catalytic Reduction	
Sugar Creek Generating Station	55364	CT12	Dry Low NOx Burners and Selective Catalytic Reduction	
Tanners Creek	988	U1	Low NOx Burner Technology and SNCR	Shut Down in 2015
Tanners Creek	988	U2	Low NOx Burner Technology and SNCR	Shut Down in 2015
Tanners Creek	988	U3	Low NOx Burner Technology and SNCR	Shut Down in 2015
Tanners Creek	988	U4	None	Shut Down in 2015
Wabash River Gen Station	1010	1	Steam Injection	IGCC
Wabash River Gen Station	1010	2	Modified Low NOx Burner Design	Shut Down in 2016
Wabash River Gen Station	1010	3	Modified Low NOx Burner Design	Shut Down in 2016
Wabash River Gen Station	1010	4	Modified Low NOx Burner Design	Shut Down in 2016
Wabash River Gen Station	1010	5	Modified Low NOx Burner Design	Shut Down in 2016
Wabash River Gen Station	1010	6	Modified Low NOx Burner Design	Shut Down in 2017
Wheatland Generating Facility Ll	55224	EU-01	Water Injection System	NG-fired
Wheatland Generating Facility Ll	55224	EU-02	Water Injection System	NG-fired
Wheatland Generating Facility Ll	55224	EU-03	Water Injection System	NG-fired
Wheatland Generating Facility Ll	55224	EU-04	Water Injection System	NG-fired
Whitewater Valley	1040	1	Low NOx Burner Technology (Dry Bottom only) w/ Ammonia Injection Overfire Air	
Whitewater Valley	1040	2	Low NOx Burner Technology (Dry Bottom only) w/ Ammonia Injection Overfire Air	
Whiting Clean Energy, Inc.	55259	CT1	Dry Low NOx Burners and Selective Catalytic Reduction	
Whiting Clean Energy, Inc.	55259	CT2	Dry Low NOx Burners and Selective Catalytic Reduction	
Worthington Generation	55148	1	Water Injection System	NG-fired
Worthington Generation	55148	2	Water Injection System	NG-fired
Worthington Generation	55148	3	Water Injection System	NG-fired
Worthington Generation	55148	4	Water Injection System	NG-fired

Facility Name	Facility ID (ORISPL)	Unit ID	Existing NOx Control	Projected Retrofit/Construction, Shutdown or Comment
Alcoa	6705	1	Low NOx Burner Technology w/ Overfire Air	
Alcoa	6705	2	Low NOx Burner Technology w/ Overfire Air	
Alcoa	6705	3	Low NOx Burner Technology w/ Overfire Air	
BP Whiting Business Unit	52130	1SPS13	None	Shut down 2007
BP Whiting Business Unit	52130	1SPS14	None	Shut down 2007
BP Whiting Business Unit	52130	1SPS15	None	Shut down 2009/Required to shut down by 2010 as part of Consent Decree 2:96CV 095RL
BP Whiting Business Unit	52130	1SPS16	None	Shut down 2009/Required to shut down by 2010 as part of Consent Decree 2:96CV 095RL
BP Whiting Business Unit	52130	1SPS17	None	Shut down 2009/Required to shut down by 2010 as part of Consent Decree 2:96CV 095RL
BP Whiting Business Unit	52130	3SPS31	Selective Catalytic Reduction	
BP Whiting Business Unit	52130	3SPS32	Selective Catalytic Reduction	
BP Whiting Business Unit	52130	3SPS33	Selective Catalytic Reduction	
BP Whiting Business Unit	52130	3SPS34	Selective Catalytic Reduction	
BP Whiting Business Unit	52130	3SPS36	Selective Catalytic Reduction	
C. C. Perry K Steam Plant	992	11	None	Fuel Switch to NG in 1998
C. C. Perry K Steam Plant	992	12	None	Fuel Switch to NG in 2016
C. C. Perry K Steam Plant	992	13	None	Fuel Switch to NG in 1998
C. C. Perry K Steam Plant	992	14	None	Fuel Switch to NG in 1998
C. C. Perry K Steam Plant	992	15	None	Fuel Switch to NG in 2016
C. C. Perry K Steam Plant	992	16	None	Fuel Switch to NG in 2016
Grain Processing Corporation		Boiler 1	Low NOx Burner and Flue Gas Recirculation System	Installed 2000, repermitted 2015
Grain Processing Corporation		Boiler 2	Low NOx Burner and Flue Gas Recirculation System	Installed 2000, repermitted 2015
Mittal Steel USA Indiana Harbor	10474	211	None	Shutdown 2008
Mittal Steel USA Indiana Harbor	10474	212	None	Shutdown 2010
Mittal Steel USA Indiana Harbor	10474	213	None	Shutdown 2010
Mittal Steel USA Indiana Harbor	10474	401	None	Shutdown 2003
Mittal Steel USA Indiana Harbor	10474	402	None	Shutdown 2003
Mittal Steel USA Indiana Harbor	10474	403	None	Shutdown 2003
Mittal Steel USA Indiana Harbor	10474	404	None	Shutdown 2003
Mittal Steel USA Indiana Harbor	10474	405	None	Shutdown 2003
Mittal Steel USA Indiana Harbor	10474	501	None	Blast Furnace Gas and NG-fired
Mittal Steel USA Indiana Harbor	10474	502	None	Blast Furnace Gas and NG-fired
Mittal Steel USA Indiana Harbor	10474	503	None	Blast Furnace Gas and NG-fired
Mittal Steel USA Indiana Harbor	10474	504	None	Blast Furnace Gas and NG-fired
Noble Americas South Bend	880087	D-4000	None	Shut down 2012
Portside	55096	BLR1	Low NOx Burner and Flue Gas Recirculation System	
Portside	55096	BLR2	Low NOx Burner and Flue Gas Recirculation System	
Portside	55096	CT	Dry Low NOx Burner	
Purdue University	50240	2	Low NOx Burner Technology (Dry Bottom only)	NG-fired
Purdue University	50240	3	None	NG and Distillate Fuel Oil-fired
Purdue University	50240	5	None	Coal-fired
Purdue University	50240	7	Low NOx Burner Technology (Dry Bottom only) and Combustion	NG fired

Facility Name	Facility ID (ORISPL)	Unit ID	Existing NOx Control	Projected Retrofit/Construction, Shutdown or Comment
Rockport	6166	AB1	None	No. 2 Fuel Oil-fired
Rockport	6166	AB2	None	No. 2 Fuel Oil-fired
SABIC		Cogen	Oxidation Catalyst	
US Steel Corp - Gary Works	50733	701B1	None	Blast Furnace Gas, Coke Oven Gas, Fuel Oil and NG-fired
US Steel Corp - Gary Works	50733	701B2	None	Blast Furnace Gas, Coke Oven Gas, Fuel Oil and NG-fired
US Steel Corp - Gary Works	50733	701B3	None	Blast Furnace Gas, Coke Oven Gas, Fuel Oil and NG-fired
US Steel Corp - Gary Works	50733	701B5	None	Blast Furnace Gas, Coke Oven Gas, Fuel Oil and NG-fired
US Steel Corp - Gary Works	50733	701B6	None	Blast Furnace Gas and NG-fired
US Steel Corp - Gary Works	50733	720B1	None	Blast Furnace Gas, Fuel Oil and NG-fired
US Steel Corp - Gary Works	50733	720B2	None	Blast Furnace Gas, Fuel Oil and NG-fired
US Steel Corp - Gary Works	50733	720B3	None	Blast Furnace Gas and NG-fired

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Facility Name	Facility ID (ORISPL)	Unit ID	Annual NOx Emissions (tons/yr)									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
A B Brown Generating Station	6137	1	2416.431	742.416	786.122	818.626	1068.925	1034.746	1498.786	1215.665	677.199	775.796
A B Brown Generating Station	6137	2	2958.201	965.688	886.451	934.031	1033.549	760.460	1359.053	911.064	999.339	816.465
A B Brown Generating Station	6137	3	14.743	11.363	23.493	15.421	16.085	6.942	6.845	8.417	15.184	10.408
A B Brown Generating Station	6137	4	2.513	1.398	2.197	2.571	2.622	3.273	1.837	3.496	2.310	2.693
Alcoa Allowance Management Inc	6705	4	3104.162	1576.243	1229.968	1612.132	2191.544	2825.220	3166.497	3319.330	3058.249	1929.521
Anderson	7336	ACT1	0.978	0.858	0.398	2.161	2.086	0.932	1.582	2.395	1.614	2.192
Anderson	7336	ACT2	1.167	0.926	0.454	2.413	3.332	1.209	1.784	2.197	1.577	1.742
Anderson	7336	ACT3	0.765	1.069	0.337	1.624	2.310	0.761	1.715	1.089	1.916	0.974
Bailly Generating Station	995	10	0.353	0.712	2.205	2.674	5.283	1.935	1.468	0.868	2.717	0.118
Bailly Generating Station	995	7	3382.404	996.415	1168.822	682.708	582.277	686.035	639.717	539.784	611.208	532.931
Bailly Generating Station	995	8	6359.184	1462.897	1583.449	1289.037	928.331	1236.092	1085.072	531.680	731.319	635.396
Broadway Avenue Generating Station	1011	1	8.159	4.569	3.987	7.249	6.770	0.830				
Broadway Avenue Generating Station	1011	2	49.955	16.535	18.205	13.635	13.533	5.054	8.085	15.386	13.042	6.615
Cayuga	1001	1	4568.542	3455.757	4357.481	4101.842	3968.233	4385.937	4301.511	6772.084	5322.102	4201.384
Cayuga	1001	2	4764.068	3405.085	3971.556	4146.253	3599.509	5307.432	4383.102	3732.266	7047.344	2859.765
Cayuga	1001	4	3.248	4.798	3.550	3.746	9.714	10.108	7.523	3.792	0.155	0.146
Clifty Creek	983	1	3192.686	686.998	861.184	1352.554	2497.280	1468.859	1229.578	992.189	1187.751	796.313
Clifty Creek	983	2	3295.708	715.540	918.214	1333.360	2197.474	2558.185	1412.697	753.631	1469.795	803.879
Clifty Creek	983	3	3434.306	551.617	877.453	1328.735	2854.207	1312.763	708.500	933.400	1329.456	517.979
Clifty Creek	983	4	3832.358	2004.776	2135.024	2463.462	2035.439	1558.968	1934.848	1197.140	1875.958	1306.600
Clifty Creek	983	5	3588.600	1954.905	2151.239	2036.722	2134.114	2540.124	2079.312	1568.009	1727.534	1269.819
Clifty Creek	983	6	3203.080	2104.956	2175.583	2423.192	2097.932	2403.072	1767.034	1311.196	1764.911	1067.642
Connersville Peaking Station	1002	1A	0.435		0.116	0.096	0.199	0.967	0.629	0.517	0.597	0.471
Connersville Peaking Station	1002	1B	0.402		0.104	0.110	0.283	0.967	0.629	0.517	0.597	0.471
Connersville Peaking Station	1002	2A	0.549		0.169	0.114	0.274	1.093	0.569	0.489	1.299	0.541
Connersville Peaking Station	1002	2B	0.525		0.288	0.132	0.287	1.093	0.569	0.489	1.288	0.534
Dean H Mitchell Generating Station	996	11										
Dean H Mitchell Generating Station	996	4										
Dean H Mitchell Generating Station	996	5										
Dean H Mitchell Generating Station	996	6										
Duke Vermillion Generating Station	55111	1	2.492	1.551	2.261	1.698	2.361	4.221	1.038	3.940	4.126	2.574
Duke Vermillion Generating Station	55111	2	2.809	2.426	1.732	1.112	1.964	1.949	0.602	3.580	4.801	1.283
Duke Vermillion Generating Station	55111	3	2.634	1.852	3.023	1.684	2.147	3.246	1.442	3.221	2.735	1.908
Duke Vermillion Generating Station	55111	4	3.168	1.931	2.668	2.145	2.106	1.593	0.716	3.988	4.197	1.809
Duke Vermillion Generating Station	55111	5	1.997	2.226	1.992	1.833	2.183	1.964	0.677	2.254	5.657	2.928
Duke Vermillion Generating Station	55111	6	1.772	1.878	2.329	1.837	2.081	1.892	0.528	3.761	4.245	2.261
Duke Vermillion Generating Station	55111	7	1.317	1.279	2.176	1.397	2.376	1.312	0.646	3.729	3.033	2.139
Duke Vermillion Generating Station	55111	8	2.230	1.923	2.535	2.144	1.980	1.037	0.616	2.470	3.079	0.980
Edwardsport Generating Station	1004	6-1										
Edwardsport Generating Station	1004	7-1	464.328	77.503	164.553							
Edwardsport Generating Station	1004	7-2	266.487	56.365	224.696							
Edwardsport Generating Station	1004	8-1	428.731	94.105	182.660							
Edwardsport Generating Station	1004	CTG1					46.261	275.130	370.014	392.745	416.798	450.923
Edwardsport Generating Station	1004	CTG2					44.151	343.194	328.798	448.474	344.694	387.200

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Facility Name	Facility ID (ORISPL)	Unit ID	Annual NOx Emissions (tons/yr)									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
F B Culley Generating Station	1012	1										
F B Culley Generating Station	1012	2	872.217	237.499	299.393	152.908	290.572	306.050	372.880	92.539	364.113	215.839
F B Culley Generating Station	1012	3	1602.337	783.918	1181.541	871.670	1093.624	1198.032	971.144	777.770	744.334	1124.099
Frank E Ratts	1043	1SG1	1286.698	1097.562	908.761	450.383	293.272	379.962	355.830	92.279		
Frank E Ratts	1043	2SG1	2197.417	1326.560	951.235	620.993	254.521	360.263	369.372			
Georgetown Substation	7759	GT1	0.750	0.280	1.878	2.505	3.482	3.040	1.070	2.833	6.653	5.820
Georgetown Substation	7759	GT2	0.355	1.316	3.339	3.349	6.968	5.580	0.957	7.085	10.382	6.655
Georgetown Substation	7759	GT3	0.244	1.070	2.704	3.030	5.686	4.426	0.818	5.695	8.047	5.845
Georgetown Substation	7759	GT4	0.398	0.343	2.121	2.547	5.394	3.885	1.486	3.293	6.945	6.234
Gibson	6113	1	6252.994	1345.308	2229.330	2609.481	2060.027	2518.356	2176.043	1832.777	1886.513	2509.256
Gibson	6113	2	6846.195	2229.229	2896.137	3860.771	3281.848	1909.070	2711.554	2216.439	2953.112	1604.650
Gibson	6113	3	7524.600	2904.033	3420.352	3096.435	3039.540	3076.618	2810.476	2051.120	3018.736	2207.657
Gibson	6113	4	4451.583	1287.981	1768.237	2536.507	2133.726	2016.165	1690.278	1647.527	2059.007	2282.922
Gibson	6113	5	4473.924	1802.077	1704.392	2921.096	2126.887	1877.220	4903.805	3086.087	3272.770	2780.660
Harding Street Station (EW Stout)	990	10	0.476	0.019	1.994	0.016						
Harding Street Station (EW Stout)	990	50	953.756	727.850	892.128	739.028	811.478	823.777	861.486	449.470	81.854	24.107
Harding Street Station (EW Stout)	990	60	985.003	761.677	689.927	700.009	759.641	812.333	832.539	349.880	71.664	23.688
Harding Street Station (EW Stout)	990	70	2594.966	1226.577	1023.471	1177.388	1494.603	2610.092	2693.445	1573.746	762.765	306.195
Harding Street Station (EW Stout)	990	9	0.156	1.080	3.171	0.045						
Harding Street Station (EW Stout)	990	GT4	5.323	1.223	21.524	21.662	15.471	23.853	18.225	38.765	53.359	32.937
Harding Street Station (EW Stout)	990	GT5	5.375	2.142	18.781	21.499	18.685	25.078	13.334	32.312	38.739	18.200
Harding Street Station (EW Stout)	990	GT6	2.953	1.209	7.181	9.737	9.577	10.494	9.667	36.450	27.771	38.495
Henry County Generating Station	7763	1	6.567	6.496	9.747	5.344	11.807	11.511	8.772	23.836	19.361	36.630
Henry County Generating Station	7763	2	6.465	5.817	9.039	7.670	11.836	11.287	8.433	25.804	26.531	41.010
Henry County Generating Station	7763	3	6.359	5.936	8.581	6.577	11.608	10.990	8.397	18.972	23.423	31.662
Hoosier Energy Lawrence Co Station	7948	1	2.198	1.371	3.634	2.917	5.554	2.125	2.684	2.414	3.376	2.660
Hoosier Energy Lawrence Co Station	7948	2	1.994	1.787	3.785	3.177	6.052	2.515	2.879	1.576	2.570	2.677
Hoosier Energy Lawrence Co Station	7948	3	2.047	1.433	4.011	3.143	6.238	1.992	2.306	1.562	2.779	2.548
Hoosier Energy Lawrence Co Station	7948	4	1.476	1.294	3.023	3.673	5.114	1.513	2.124	1.423	2.747	2.719
Hoosier Energy Lawrence Co Station	7948	5	1.070	1.409	2.789	3.698	5.921	1.347	1.884	0.996	2.499	4.203
Hoosier Energy Lawrence Co Station	7948	6	1.415	2.273	3.567	2.286	6.012	1.312	1.939	1.057	4.285	5.324
Eagle Valley Generating Station	991	1	0.314		2.144	1.085						
Eagle Valley Generating Station	991	2	0.275		2.835	1.528						
Eagle Valley Generating Station	991	3	589.288	64.264	263.207	301.735	27.907	38.354	56.575	32.294		
Eagle Valley Generating Station	991	4	607.355	367.864	535.191	536.485	83.167	48.758	254.993	85.202	9.541	
Eagle Valley Generating Station	991	5	401.945	309.125	348.281	282.429	153.023	266.703	290.408	97.449	56.713	
Eagle Valley Generating Station	991	6	749.109	720.283	615.631	672.587	292.574	518.887	662.781	212.340	116.605	
Lawrenceburg Energy Facility	55502	1	13.677	10.089	16.929	41.757	65.215	35.906	72.168	91.275	87.089	101.330
Lawrenceburg Energy Facility	55502	2	10.485	9.217	16.217	41.273	64.540	39.511	73.637	90.514	77.360	74.947
Lawrenceburg Energy Facility	55502	3	12.208	10.039	20.701	40.393	64.519	38.408	55.040	77.630	100.130	76.170
Lawrenceburg Energy Facility	55502	4	12.183	7.485	19.057	39.776	58.024	44.209	63.464	85.493	91.632	71.106
Merom	6213	1SG1	3257.459	1938.890	2177.287	1655.438	1296.941	959.467	1131.430	729.714	1038.347	727.983
Merom	6213	2SG1	3898.770	2281.594	1838.725	1671.536	949.684	1082.197	912.290	890.058	904.365	837.293
Michigan City Generating Station	997	12	3877.248	1095.730	1160.496	1431.886	1169.681	1115.538	1241.073	793.937	815.401	621.444
Michigan City Generating Station	997	4										
Michigan City Generating Station	997	5										
Michigan City Generating Station	997	6										

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Annual NOx Emissions (tons/yr)									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Montpelier Electric Gen Station	55229	G1CT1	3.429	2.344	5.963	5.944	9.868	7.978	8.610	14.579	15.870	11.859
Montpelier Electric Gen Station	55229	G1CT2	3.592	2.745	7.228	5.722	10.234	7.465	8.424	16.982	8.237	10.504
Montpelier Electric Gen Station	55229	G2CT1	4.465	2.482	6.066	5.574	9.965	9.498	10.304	18.476	17.544	12.168
Montpelier Electric Gen Station	55229	G2CT2	4.002	1.958	5.488	6.020	10.336	8.036	9.011	14.565	24.368	8.210
Montpelier Electric Gen Station	55229	G3CT1	4.219	2.475	5.931	6.619	9.960	7.576	8.016	17.025	15.343	13.573
Montpelier Electric Gen Station	55229	G3CT2	3.078	2.017	5.088	5.992	10.340	6.669	6.728	14.950	22.545	12.009
Montpelier Electric Gen Station	55229	G4CT1	3.554	2.461	6.290	6.144	10.653	8.661	9.353	19.636	16.125	13.926
Montpelier Electric Gen Station	55229	G4CT2	3.522	2.304	5.772	6.297	11.041	7.952	9.064	13.331	22.063	14.689
Noblesville	1007	1										
Noblesville	1007	2										
Noblesville	1007	3										
Noblesville	1007	CT3	10.148	2.943	9.281	6.819	17.801	10.555	9.192	18.244	23.975	9.711
Noblesville	1007	CT4	9.896	3.013	7.872	8.701	17.577	13.755	10.796	18.875	19.482	9.884
Noblesville	1007	CT5	11.103	3.772	7.518	12.742	19.511	13.477	11.052	23.015	22.882	12.596
Petersburg Generating Station	994	1	2272.287	1629.887	1619.920	1516.460	1743.585	1868.411	1992.141	2339.650	1972.731	1717.337
Petersburg Generating Station	994	2	3495.099	1159.161	2795.172	2133.304	1555.145	1412.596	3053.995	3082.193	1708.254	1209.866
Petersburg Generating Station	994	3	4854.543	2262.909	2010.731	2276.894	1833.033	3583.401	3149.011	2657.099	3112.887	1694.718
Petersburg Generating Station	994	4	5176.695	4606.037	4779.778	3739.846	4160.980	4042.618	4852.654	4347.840	4019.327	3750.877
R Gallagher	1008	1	1250.111	628.979	942.553	330.580	0.784					
R Gallagher	1008	2	1590.971	990.839	1194.912	371.575	336.734	727.402	859.550	512.465	320.344	213.267
R Gallagher	1008	3	1029.180	802.063	735.964	363.587	0.468					
R Gallagher	1008	4	1071.615	666.194	1048.547	278.820	166.426	472.619	797.147	427.926	328.202	179.719
R M Schahfer Generating Station	6085	14	7180.893	3335.949	1835.471	1278.559	782.366	910.809	939.144	332.768	280.586	383.951
R M Schahfer Generating Station	6085	15	4745.436	2167.607	3093.707	2370.009	2086.380	1755.608	1593.964	1420.811	773.974	649.398
R M Schahfer Generating Station	6085	16A	9.788	5.943	15.973	23.260	48.940	12.208	13.061	32.873	13.570	19.339
R M Schahfer Generating Station	6085	16B	30.173	5.132	15.834	16.529	28.547	10.410	11.985	29.975		6.542
R M Schahfer Generating Station	6085	17	2434.093	2755.162	2051.179	1770.095	1147.585	1590.292	2374.415	1372.361	1771.320	1455.304
R M Schahfer Generating Station	6085	18	2963.192	2296.037	2602.971	1908.229	1846.406	2467.119	2183.326	1983.530	1557.115	2410.383
Richmond (IN)	7335	RCT1	1.207	0.226	1.186	1.924	1.047	0.999	0.848	2.339	1.350	3.086
Richmond (IN)	7335	RCT2	1.187	0.197	1.154	2.397	1.957	1.178	0.848	2.317	1.319	2.892
Rockport	6166	MB1	11998.698	10906.118	10804.457	7520.927	11016.471	10351.579	10363.507	6534.632	6043.043	4631.027
Rockport	6166	MB2	10960.598	8856.058	9740.853	12288.053	10627.212	6849.242	9362.440	7387.054	6845.039	6630.039
St. Josph Energy Center		CTG01A										
St. Josph Energy Center		CTG01B										
St. Josph Energy Center		CTG02A										
St. Josph Energy Center		CTG02B										
State Line Generating Station (IN)	981	3	1835.567	1377.044	1856.898	1707.874	324.535					
State Line Generating Station (IN)	981	4	7266.077	4613.890	6383.127	5294.465	1186.320					
Sugar Creek Generating Station	55364	CT11	9.313	24.102	43.925	42.650	49.069	44.570	40.474	44.327	54.647	61.358
Sugar Creek Generating Station	55364	CT12	7.257	22.370	46.092	44.943	51.523	44.029	41.704	46.071	55.760	59.840
Tanners Creek	988	U1	1230.107	118.041	469.806	343.219	157.781	92.734	209.709	4.296		
Tanners Creek	988	U2	1367.177	426.352	399.870	889.745	246.142	308.416	469.070	218.148		
Tanners Creek	988	U3	1722.558	937.367	666.029	623.904	936.544	919.273	1172.991	630.914		
Tanners Creek	988	U4	3109.329	2047.549	3140.264	3238.580	2178.556	1628.360	1848.804	963.134		

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Annual NOx Emissions (tons/yr)									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Wabash River Gen Station	1010	1	315.288	306.720	307.374	363.964	254.222	431.508	385.737	374.948	163.086	14.035
Wabash River Gen Station	1010	2	1140.424	379.622		645.332	372.006	349.579	302.521	87.861		
Wabash River Gen Station	1010	3	1092.573	310.098		723.614	309.708	403.849	320.715	292.082		
Wabash River Gen Station	1010	4	1103.292	1033.024	1194.427	1006.575	364.765	360.507	431.770	305.046		
Wabash River Gen Station	1010	5	1217.788	276.918		382.032	79.335	169.548	260.042	15.258		
Wabash River Gen Station	1010	6	3724.372	3668.133	3599.203	3976.330	1747.589	1976.431	1650.987	2465.886	778.787	
Wheatland Generating Facility LLC	55224	EU-01	1.503	5.554	17.657	15.571	25.876	27.236	12.826	17.283	31.274	19.194
Wheatland Generating Facility LLC	55224	EU-02	2.066	4.189	14.263	13.332	10.278	22.370	10.516	15.372	32.309	19.060
Wheatland Generating Facility LLC	55224	EU-03	0.578	4.344	9.981	11.128	19.972	16.897	8.933	2.911	2.302	14.997
Wheatland Generating Facility LLC	55224	EU-04	5.478	3.472	11.460	10.202	25.440	14.872	11.516	17.543	27.007	14.063
Whitewater Valley	1040	1	240.705	80.557	136.541	137.840	17.599	13.210	26.959	32.832	38.855	27.867
Whitewater Valley	1040	2	611.659	288.772	222.184	238.050	35.354	26.549	65.059	69.075	85.570	61.694
Whiting Clean Energy, Inc.	55259	CT1	31.679	31.533	54.419	59.171	50.038	65.385	45.047	55.050	58.323	43.543
Whiting Clean Energy, Inc.	55259	CT2	41.423	48.445	47.697	49.108	54.011	35.575	55.462	43.688	52.627	41.154
Worthington Generation	55148	1	2.950	1.527	3.053	2.407	2.313	0.854	0.667	5.113	7.392	7.257
Worthington Generation	55148	2	2.848	0.925	2.117	1.750	1.963	0.263	0.480	4.101	6.597	5.646
Worthington Generation	55148	3	1.780	1.066	1.977	2.037	1.866	0.268	1.205	4.037	4.631	3.531
Worthington Generation	55148	4	2.653	1.613	2.760	1.712	1.790	0.630	1.146	4.984	5.856	6.467
Total Annual NOx Emissions			**190,092**	**102,606**	**112,835**	**109,239**	**95,386**	**94,056**	**100,975**	**80,620**	**77,752**	**59,714**

Facility Name	Facility ID (ORISPL)	Unit ID	Annual NOx Emissions (tons/yr)									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Alcoa	6705	1	2028.429	3219.235	3111.418	3605.759	3208.780	2377.135	2520.058	2223.674	1310.105	877.482
Alcoa	6705	2	2195.518	2416.844	2361.836	3174.733	2322.854	2566.289	2474.932	2529.978	1234.502	819.005
Alcoa	6705	3	2283.546	2700.041	2616.087	2878.179	2968.508	2183.433	2618.613	2367.113	1234.408	523.473
BP Whiting Business Unit	52130	1SPS13										
BP Whiting Business Unit	52130	1SPS14										
BP Whiting Business Unit	52130	1SPS15	54.870	47.626								
BP Whiting Business Unit	52130	1SPS16	52.272	37.528								
BP Whiting Business Unit	52130	1SPS17	64.205	18.314								
BP Whiting Business Unit	52130	3SPS31	132.101	112.627	41.862	8.374	11.237	12.292	12.686	12.266	11.069	11.198
BP Whiting Business Unit	52130	3SPS32	117.517	90.340	38.609	9.645	11.184	9.972	13.719	9.557	5.755	12.351
BP Whiting Business Unit	52130	3SPS33	86.820	70.965	22.316	7.978	4.964	7.697	14.084	6.555	11.610	6.929
BP Whiting Business Unit	52130	3SPS34	97.776	25.013	16.855	17.408	8.680	8.306	13.330	14.737	13.374	7.847
BP Whiting Business Unit	52130	3SPS36	33.373	56.227	24.312	10.482	11.547	10.655	15.583	12.767	12.397	29.393
C. C. Perry K Steam Plant	992	11	80.694	59.484	56.566	42.953	47.290	86.461	127.771	158.697	174.115	172.915
C. C. Perry K Steam Plant	992	12	110.690	269.623	277.317	241.288	249.223	258.034	79.672	73.240	85.789	79.712
C. C. Perry K Steam Plant	992	13	9.546	34.306	20.494	15.917	15.204	43.008	34.598	34.066	30.069	33.428
C. C. Perry K Steam Plant	992	14	53.286	17.853	14.264	5.622	4.663	34.044	63.068	55.135	43.356	40.410
C. C. Perry K Steam Plant	992	15	258.517	269.123	288.101	250.009	247.644	205.174	77.183			
C. C. Perry K Steam Plant	992	16	204.136	236.079	269.827	258.395	258.912	335.318	109.212	8.769	5.831	4.186
Grain Processing Corporation		Boiler 1	513.950	461.160	489.910	460.280	222.000					
Grain Processing Corporation		Boiler2	29.140	24.600	18.940	93.610	18.940		0.281	4.641	8.732	8.025
Mittal Steel USA Indiana Harbor East	10474	211	4.192									
Mittal Steel USA Indiana Harbor East	10474	212			21.997							
Mittal Steel USA Indiana Harbor East	10474	213	8.135	0.707	9.963							
Mittal Steel USA Indiana Harbor East	10474	401										
Mittal Steel USA Indiana Harbor East	10474	402										
Mittal Steel USA Indiana Harbor East	10474	403										
Mittal Steel USA Indiana Harbor East	10474	404										
Mittal Steel USA Indiana Harbor East	10474	405										
Mittal Steel USA Indiana Harbor East	10474	501	84.240	92.119	105.773	53.825	41.023	52.393	20.167	34.875	64.632	229.584
Mittal Steel USA Indiana Harbor East	10474	502	84.153	78.422	105.424	57.028	41.906	60.874	24.041	35.830	57.344	251.408
Mittal Steel USA Indiana Harbor East	10474	503	83.504	101.682	101.933	55.412	41.851	51.824	22.346	33.851	68.135	90.626
Mittal Steel USA Indiana Harbor East	10474	504						176.928	38.748	66.963	97.786	107.318
Noble Americas South Bend Ethanol	880087	U-4000	200.394	201.283	204.603	182.950	80.614					
Portside	55096	BLR1	6.549	0.122	2.914	3.461	4.243	0.504	0.090	0.228	0.330	0.800
Portside	55096	BLR2	13.231	4.981	1.931	3.217	0.483	1.091	1.585	1.561	1.227	2.099
Portside	55096	CT	27.869	25.087	25.760	24.827	25.574	23.583	23.631	23.709	23.896	22.818
Purdue University	50240	1	138.034	251.282	277.803	234.694	180.448					
Purdue University	50240	2	161.204	343.717	303.531	293.506	280.897	303.060	169.420	73.490	105.960	54.849
Purdue University	50240	3	11.538	1.282	5.638	17.150	14.140	14.545	47.407	51.661	38.569	75.706
Purdue University	50240	5	38.705	97.823	91.683	84.515	83.222	43.077	93.533	92.803	120.473	82.341
Purdue University	50240	7					8.102	19.779	23.717	22.298	26.311	24.397
Rockport	6166	AB1	0.276	0.123	1.025	0.113	0.119	1.121	0.758	0.044		1.105
Rockport	6166	AB2	0.209	0.112	1.038	0.180	0.135	1.206	0.776	0.054		1.165
SABIC		Cogen									10.916	152.774

Facility Name	Facility ID (ORISPL)	Unit ID	Annual NOx Emissions (tons/yr)									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
US Steel Corp - Gary Works	50733	701B1	28.930	28.753	233.254	24.755	57.540	12.783	12.141	18.855	15.415	20.959
US Steel Corp - Gary Works	50733	701B2	23.762	14.813	29.009	11.447	11.663	15.426	11.270	11.150	13.716	19.225
US Steel Corp - Gary Works	50733	701B3	18.288	12.928	27.033	30.996	10.796	12.750	8.210	11.156	11.604	16.685
US Steel Corp - Gary Works	50733	701B5	10.052	13.140	7.559	10.200	14.262	8.410	5.375	4.211	1.603	7.667
US Steel Corp - Gary Works	50733	701B6	15.321	17.414	21.811	42.407	26.399	20.829	24.706	23.762	22.519	36.624
US Steel Corp - Gary Works	50733	720B1	10.536	4.929	12.474	14.051	9.711	9.242	5.762	5.311	4.394	5.034
US Steel Corp - Gary Works	50733	720B2	12.676	12.570	15.612	14.464	13.025	12.273	10.622	15.681	5.988	9.784
US Steel Corp - Gary Works	50733	720B3	10.823	10.590	17.618	15.926	10.530	11.759	14.264	16.574	10.515	28.460
Total Annual NOx Emissions			**9,399**	**11,481**	**11,294**	**12,256**	**10,568**	**8,991**	**8,733**	**8,055**	**4,882**	**3,868**

Note: Numbers shown in red were obtained from Indiana's Emission Inventory Tracking System because emissions were not reported to CAMD.

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Appendix G

Indiana's EGUs with Existing Consent Decree Caps and Planned Future Retirements

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STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	2021-22 Annual NOx Consent Decree Cap (if applicable) (tons)
A B Brown Generating Station	6137	1	
A B Brown Generating Station	6137	2	
A B Brown Generating Station	6137	3	
A B Brown Generating Station	6137	4	
Alcoa Allowance Management Inc	6705	4	
Anderson	7336	ACT1	
Anderson	7336	ACT2	
Anderson	7336	ACT3	
Bailly Generating Station	995	10	
Bailly Generating Station	995	7	827
Bailly Generating Station	995	8	1,419
Broadway Avenue Generating Station	1011	1	
Broadway Avenue Generating Station	1011	2	
Cayuga	1001	1	
Cayuga	1001	2	
Cayuga	1001	4	
Clifty Creek	983	1	
Clifty Creek	983	2	
Clifty Creek	983	3	
Clifty Creek	983	4	
Clifty Creek	983	5	
Clifty Creek	983	6	
Connersville Peaking Station	1002	1A	
Connersville Peaking Station	1002	1B	
Connersville Peaking Station	1002	2A	
Connersville Peaking Station	1002	2B	
Dean H Mitchell Generating Station	996	11	
Dean H Mitchell Generating Station	996	4	
Dean H Mitchell Generating Station	996	5	
Dean H Mitchell Generating Station	996	6	
Duke Vermillion Generating Station	55111	1	
Duke Vermillion Generating Station	55111	2	
Duke Vermillion Generating Station	55111	3	
Duke Vermillion Generating Station	55111	4	
Duke Vermillion Generating Station	55111	5	
Duke Vermillion Generating Station	55111	6	
Duke Vermillion Generating Station	55111	7	
Duke Vermillion Generating Station	55111	8	
Edwardsport Generating Station	1004	6-1	
Edwardsport Generating Station	1004	7-1	
Edwardsport Generating Station	1004	7-2	
Edwardsport Generating Station	1004	8-1	
Edwardsport Generating Station	1004	CTG1	
Edwardsport Generating Station	1004	CTG2	
F B Culley Generating Station	1012	1	
F B Culley Generating Station	1012	2	
F B Culley Generating Station	1012	3	
Frank E Ratts	1043	1SG1	451
Frank E Ratts	1043	2SG1	473
Georgetown Substation	7759	GT1	

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	2021-22 Annual NOx Consent Decree Cap (if applicable) (tons)
Georgetown Substation	7759	GT2	
Georgetown Substation	7759	GT3	
Georgetown Substation	7759	GT4	
Gibson	6113	1	
Gibson	6113	2	
Gibson	6113	3	
Gibson	6113	4	
Gibson	6113	5	
Harding Street Station (EW Stout)	990	10	
Harding Street Station (EW Stout)	990	50	
Harding Street Station (EW Stout)	990	60	
Harding Street Station (EW Stout)	990	70	
Harding Street Station (EW Stout)	990	9	
Harding Street Station (EW Stout)	990	GT4	
Harding Street Station (EW Stout)	990	GT5	
Harding Street Station (EW Stout)	990	GT6	
Henry County Generating Station	7763	1	
Henry County Generating Station	7763	2	
Henry County Generating Station	7763	3	
Hoosier Energy Lawrence Co Station	7948	1	
Hoosier Energy Lawrence Co Station	7948	2	
Hoosier Energy Lawrence Co Station	7948	3	
Hoosier Energy Lawrence Co Station	7948	4	
Hoosier Energy Lawrence Co Station	7948	5	
Hoosier Energy Lawrence Co Station	7948	6	
Eagle Valley Generating Station	991	1	
Eagle Valley Generating Station	991	2	
Eagle Valley Generating Station	991	3	
Eagle Valley Generating Station	991	4	
Eagle Valley Generating Station	991	5	
Eagle Valley Generating Station	991	6	
Lawrenceburg Energy Facility	55502	1	
Lawrenceburg Energy Facility	55502	2	
Lawrenceburg Energy Facility	55502	3	
Lawrenceburg Energy Facility	55502	4	
Merom	6213	1SG1	1,950
Merom	6213	2SG1	1,926
Michigan City Generating Station	997	12	1,977
Michigan City Generating Station	997	4	
Michigan City Generating Station	997	5	
Michigan City Generating Station	997	6	
Montpelier Electric Gen Station	55229	G1CT1	
Montpelier Electric Gen Station	55229	G1CT2	
Montpelier Electric Gen Station	55229	G2CT1	
Montpelier Electric Gen Station	55229	G2CT2	
Montpelier Electric Gen Station	55229	G3CT1	
Montpelier Electric Gen Station	55229	G3CT2	
Montpelier Electric Gen Station	55229	G4CT1	
Montpelier Electric Gen Station	55229	G4CT2	
Noblesville	1007	1	
Noblesville	1007	2	

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	2021-22 Annual NOx Consent Decree Cap (if applicable) (tons)
Noblesville	1007	3	
Noblesville	1007	CT3	
Noblesville	1007	CT4	
Noblesville	1007	CT5	
Petersburg Generating Station	994	1	
Petersburg Generating Station	994	2	
Petersburg Generating Station	994	3	
Petersburg Generating Station	994	4	
R Gallagher	1008	1	
R Gallagher	1008	2	
R Gallagher	1008	3	
R Gallagher	1008	4	
R M Schahfer Generating Station	6085	14	2,120
R M Schahfer Generating Station	6085	15	2,501
R M Schahfer Generating Station	6085	16A	
R M Schahfer Generating Station	6085	16B	
R M Schahfer Generating Station	6085	17	1,989
R M Schahfer Generating Station	6085	18	2,037
Richmond (IN)	7335	RCT1	
Richmond (IN)	7335	RCT2	
Rockport	6166	MB1	
Rockport	6166	MB2	
State Line Generating Station (IN)	981	3	
State Line Generating Station (IN)	981	4	
Sugar Creek Generating Station	55364	CT11	
Sugar Creek Generating Station	55364	CT12	
Tanners Creek	988	U1	
Tanners Creek	988	U2	
Tanners Creek	988	U3	
Tanners Creek	988	U4	
Wabash River Gen Station	1010	1	
Wabash River Gen Station	1010	2	
Wabash River Gen Station	1010	3	
Wabash River Gen Station	1010	4	
Wabash River Gen Station	1010	5	
Wabash River Gen Station	1010	6	
Wheatland Generating Facility LLC	55224	EU-01	
Wheatland Generating Facility LLC	55224	EU-02	
Wheatland Generating Facility LLC	55224	EU-03	
Wheatland Generating Facility LLC	55224	EU-04	
Whitewater Valley	1040	1	
Whitewater Valley	1040	2	
Whiting Clean Energy, Inc.	55259	CT1	
Whiting Clean Energy, Inc.	55259	CT2	
Worthington Generation	55148	1	
Worthington Generation	55148	2	
Worthington Generation	55148	3	
Worthington Generation	55148	4	

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Retirement in Years 2008-2017	Retirement in Year 2018	Retirement in Year 2019	Retirement in Year 2020	Retirement in Year 2021	Retirement in Year 2022	Retirement in Year 2023
A B Brown Generating Station	6137	1							X
A B Brown Generating Station	6137	2							X
A B Brown Generating Station	6137	3							
A B Brown Generating Station	6137	4							
Alcoa Allowance Management Inc	6705	4							
Anderson	7336	ACT1							
Anderson	7336	ACT2							
Anderson	7336	ACT3							
Bailly Generating Station	995	10							
Bailly Generating Station	995	7		X					
Bailly Generating Station	995	8		X					
Broadway Avenue Generating Station	1011	1	0						
Broadway Avenue Generating Station	1011	2							
Cayuga	1001	1							
Cayuga	1001	2							
Cayuga	1001	4	0						
Clifty Creek	983	1							
Clifty Creek	983	2							
Clifty Creek	983	3							
Clifty Creek	983	4							
Clifty Creek	983	5							
Clifty Creek	983	6							
Connersville Peaking Station	1002	1A							
Connersville Peaking Station	1002	1B							
Connersville Peaking Station	1002	2A							
Connersville Peaking Station	1002	2B							
Dean H Mitchell Generating Station	996	11	0						
Dean H Mitchell Generating Station	996	4	0						
Dean H Mitchell Generating Station	996	5	0						
Dean H Mitchell Generating Station	996	6	0						
Duke Vermillion Generating Station	55111	1							
Duke Vermillion Generating Station	55111	2							
Duke Vermillion Generating Station	55111	3							
Duke Vermillion Generating Station	55111	4							
Duke Vermillion Generating Station	55111	5							
Duke Vermillion Generating Station	55111	6							
Duke Vermillion Generating Station	55111	7							
Duke Vermillion Generating Station	55111	8							
Edwardsport Generating Station	1004	6-1	0						
Edwardsport Generating Station	1004	7-1	0						
Edwardsport Generating Station	1004	7-2	0						
Edwardsport Generating Station	1004	8-1	0						
Edwardsport Generating Station	1004	CTG1							
Edwardsport Generating Station	1004	CTG2							
F B Culley Generating Station	1012	1	0						
F B Culley Generating Station	1012	2	X						
F B Culley Generating Station	1012	3							
Frank E Ratts	1043	1SG1	0						
Frank E Ratts	1043	2SG1	0						
Georgetown Substation	7759	GT1							

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Retirement in Years 2008-2017	Retirement in Year 2018	Retirement in Year 2019	Retirement in Year 2020	Retirement in Year 2021	Retirement in Year 2022	Retirement in Year 2023
Georgetown Substation	7759	GT2							
Georgetown Substation	7759	GT3							
Georgetown Substation	7759	GT4							
Gibson	6113	1							
Gibson	6113	2							
Gibson	6113	3							
Gibson	6113	4							
Gibson	6113	5							
Harding Street Station (EW Stout)	990	10	0						
Harding Street Station (EW Stout)	990	50							
Harding Street Station (EW Stout)	990	60							
Harding Street Station (EW Stout)	990	70							
Harding Street Station (EW Stout)	990	9	0						
Harding Street Station (EW Stout)	990	GT4							
Harding Street Station (EW Stout)	990	GT5							
Harding Street Station (EW Stout)	990	GT6							
Henry County Generating Station	7763	1							
Henry County Generating Station	7763	2							
Henry County Generating Station	7763	3							
Hoosier Energy Lawrence Co Station	7948	1							
Hoosier Energy Lawrence Co Station	7948	2							
Hoosier Energy Lawrence Co Station	7948	3							
Hoosier Energy Lawrence Co Station	7948	4							
Hoosier Energy Lawrence Co Station	7948	5							
Hoosier Energy Lawrence Co Station	7948	6							
Eagle Valley Generating Station	991	1	0						
Eagle Valley Generating Station	991	2	0						
Eagle Valley Generating Station	991	3	0						
Eagle Valley Generating Station	991	4	0						
Eagle Valley Generating Station	991	5	0						
Eagle Valley Generating Station	991	6	0						
Lawrenceburg Energy Facility	55502	1							
Lawrenceburg Energy Facility	55502	2							
Lawrenceburg Energy Facility	55502	3							
Lawrenceburg Energy Facility	55502	4							
Merom	6213	1SG1							
Merom	6213	2SG1							
Michigan City Generating Station	997	12							
Michigan City Generating Station	997	4	X						
Michigan City Generating Station	997	5	X						
Michigan City Generating Station	997	6	X						
Montpelier Electric Gen Station	55229	G1CT1							
Montpelier Electric Gen Station	55229	G1CT2							
Montpelier Electric Gen Station	55229	G2CT1							
Montpelier Electric Gen Station	55229	G2CT2							
Montpelier Electric Gen Station	55229	G3CT1							
Montpelier Electric Gen Station	55229	G3CT2							
Montpelier Electric Gen Station	55229	G4CT1							
Montpelier Electric Gen Station	55229	G4CT2							
Noblesville	1007	1	X						
Noblesville	1007	2	X						

STATE OF INDIANA
ELECTRIC GENERATING UNITS

Facility Name	Facility ID (ORISPL)	Unit ID	Retirement in Years 2008-2017	Retirement in Year 2018	Retirement in Year 2019	Retirement in Year 2020	Retirement in Year 2021	Retirement in Year 2022	Retirement in Year 2023
Noblesville	1007	3	X						
Noblesville	1007	CT3							
Noblesville	1007	CT4							
Noblesville	1007	CT5							
Petersburg Generating Station	994	1							
Petersburg Generating Station	994	2							
Petersburg Generating Station	994	3							
Petersburg Generating Station	994	4							
R Gallagher	1008	1	0						
R Gallagher	1008	2						X	
R Gallagher	1008	3	0						
R Gallagher	1008	4						X	
R M Schahfer Generating Station	6085	14							X
R M Schahfer Generating Station	6085	15							X
R M Schahfer Generating Station	6085	16A							
R M Schahfer Generating Station	6085	16B							
R M Schahfer Generating Station	6085	17							
R M Schahfer Generating Station	6085	18							
Richmond (IN)	7335	RCT1							
Richmond (IN)	7335	RCT2							
Rockport	6166	MB1							
Rockport	6166	MB2							
State Line Generating Station (IN)	981	3	0						
State Line Generating Station (IN)	981	4	0						
Sugar Creek Generating Station	55364	CT11							
Sugar Creek Generating Station	55364	CT12							
Tanners Creek	988	U1	0						
Tanners Creek	988	U2	0						
Tanners Creek	988	U3	0						
Tanners Creek	988	U4	0						
Wabash River Gen Station	1010	1							
Wabash River Gen Station	1010	2	0						
Wabash River Gen Station	1010	3	0						
Wabash River Gen Station	1010	4	0						
Wabash River Gen Station	1010	5	0						
Wabash River Gen Station	1010	6	0						
Wheatland Generating Facility LLC	55224	EU-01							
Wheatland Generating Facility LLC	55224	EU-02							
Wheatland Generating Facility LLC	55224	EU-03							
Wheatland Generating Facility LLC	55224	EU-04							
Whitewater Valley	1040	1							
Whitewater Valley	1040	2							
Whiting Clean Energy, Inc.	55259	CT1							
Whiting Clean Energy, Inc.	55259	CT2							
Worthington Generation	55148	1							
Worthington Generation	55148	2							
Worthington Generation	55148	3							
Worthington Generation	55148	4							

Key:
0 - Current Retirement
X - Reported Future Retirement.

Appendix H

Documentation of ERTAC EGU CONUS Versions 2.7 Reference and CSAPR Update Compliant Scenario

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Documentation of ERTAC EGU CONUS Versions 2.7 Reference and CSAPR Update Compliant Scenario

9/23/2017

ERTAC EGU Committee

Contents

1. INTRODUCTION

The ERTAC Electricity Generating Unit (EGU) Committee develops reference runs for the continental United States (CONUS). CONUS 2.7 is based on 2011 base year continuous emission monitoring (CEM) data and growth factors from the AEO2017 projection that does not include the Clean Power Plan (US Energy Information Administration January 2017). Input files to version 2.7, were developed using input received by June 2017 from a significant outreach effort to states and stakeholders. Final V2.7 runs were done by VA DEQ and OTC in September 2017. The contact person for questions about these run files is Doris McLeod (804-698-4197) for all runs except 2023. For 2023, the contact person is Joseph Jakuta (jjakuta@otcair.org). CONUS 2.7 includes both a reference run and a Cross State Air Pollution Update (CSAPR Update) Rule (81 FR 74504) compliant scenario. The reference run includes only unit change information provided by states. The CSAPR Update compliant run include additional unit adjustments, described further in this text, agreed upon by the ERTAC EGU committee to represent the EGU sector operating in compliance with the CSAPR Update rule. Projections for reference case runs have been prepared for years 2017, 2018, 2019, 2020, 2023, 2025, and 2030. Projections for CSAPR Update compliant scenario have been prepared for years 2020, 2023, 2025, 2028, and 2030. The CSAPR Update compliant files are described also as optimized runs. File names that pertain to the CSAPR Update compliant run include the “opt” identifier in file names.

The ERTAC EGU Committee maintains and distributes reference runs for the continental United States (CONUS), including the hourly input, output, summary, and documentation files for each run. These reference runs and the CSPR Update Compliant Scenario and complete documentation of the ERTAC EGU Tool is located on the MARAMA web site located here:

http://www.marama.org/2013-ertac-egu-forecasting-tool-documentation

2. ERTAC INPUT FILES

The ERTAC EGU Tool input files are built by the ERTAC leadership committee from a wide variety of existing data. These input files are subject to periodic quality assurance and updating by state agency staff. Agencies provide information on new units and controls, fuel switches, shutdowns and other unit-specific changes. In addition, the ERTAC EGU growth committee prepares updates to the growth factors when new versions of the Energy Information Agency (EIA) Annual Energy Outlook (AEO) become available. Periodic updates of these input files drive creation of new run versions. The ERTAC EGU tool projects fossil fuel fired units that report emissions to USEPA Clean Air Markets Division (CAMD) and serve a generator of at least 25 MW (there are some exemptions in the North East where units are sized less than 25 MW).

A key data source are the hourly reports of generation and emissions collected by CEM and electronically reported to CAMD by facilities for the base year, in this case 2011. Base year SO_2 and NO_X emission rates (lb/mmbtu) are calculated from this data. Future emission rates are developed from base year rates adjusted to account for state knowledge of expected emission controls, fuel switches, retirements, and new units.

The primary sources of expected future change in generation is the Energy Information Agency (EIA) annual projection of future generation and the National Energy Reliability Corporation (NERC) projection of peak generation rates. This information is available by region and fuel type. Where states have local projections these are preferred over national sources. Future generation by unit is estimated by merging these national, regional and state growth files with state knowledge of unit level changes. Hourly future emissions of NO_X and SO_2 are calculated by multiplying hourly projected future heat input by future emission rates.

ERTAC EGU Tool input files are as follows:

- **Base Year Hourly CEM data** – This comma separated file contains hourly unit level generation and emissions data extracted from EPA's CAMD database. In unit-specific situations where base year hourly data needs to be modified, users provide a non-CAMD hourly file, which may be used to adjust or add data to the base year hourly CEM file.

- **Unit Availability File (UAF)** – This tabular file contains descriptions of each generating unit derived from a variety of sources, including the CAMD NEEDS database, state input, EIA Form 860, and NERC data. Each row in the table represents a single generating unit. This file is maintained and updated by the ERTAC committee and provides information on changes to specific units from the base to the future year. For example, the UAF captures actual or planned changes to utilization fractions, unit efficiency, capacity, or fuels. State/Local/Tribal (S/L/T) agencies also add information on actual and planned new units and shutdowns.

- **Control File** – This tabular file contains known future unit specific changes to SO_2 or NO_X emission rates (in terms of lbs/mmBtu) and/or control efficiencies (for example, addition of a scrubber or selective catalytic reduction system). This information is provided by S/L/T agency staff. This file also provides emission rates for units that did not operate in the base year.

- **Seasonal Controls File** – This optional tabular file may be used by S/L/T agencies to enter seasonal or periodic future year emissions rates for specific units for use in future year runs. This file may be used in addition to, or as an alternative to, the Control File.

- **Input Variables File** – This tabular file specifies values for a number of variables used in a particular projection run.

    - **Regions and Fuel Characteristics** are not hardwired into the model. Rather, the regions and their characteristics are specified in the Input Variables File. This file allows the S/L/T agencies to specify variables such as the size, fuel type and location for new units. In addition, the regional scheme and fuel types are specified in this file.

    - **Default New Unit Emission Rates.** Percentile of best performing existing unit emission rates for use in new units. Default is 90th percentile.

    - **New Unit Hourly Profile Characteristics.** For new planned units and generation deficit units (GDUs), users may specify in this file the percentile ranking of the existing unit (operated in the base year) used to create a representative future profile of activity for new units and GDUs.

- **Growth Factor File** – This tabular file contains the annual, nonpeak and peak electrical generation growth factors delineated by geographic region and generating unit type used in a particular run.

    - **Peak Growth and Transition Hours**. The number of peak and transition hours, differentiated by fuel and region, are assigned in the Growth Factor File.

- **Demand Transfer File** – This optional file allows users to transfer power, on an hourly basis, from one region/fuel-unit type to another. It also allows transfer to or from other, non-fossil fuel fired systems such as nuclear and renewables.

3. Growth Factors

Generation for future years by fuel type are based on growth rates which are differentiated by annual, nonpeak, and peak rates.

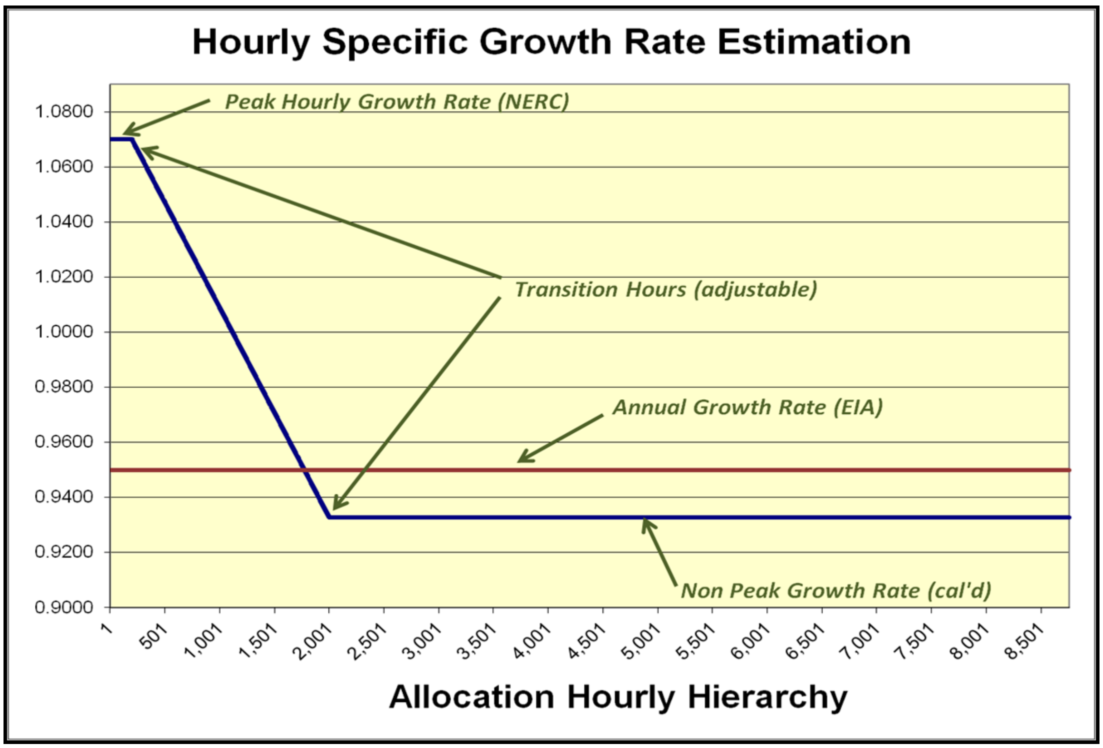
Annual growth rates are developed by the ERTAC EGU Growth subcommittee from the EIA Annual Energy Outlook (AEO) and NERC projections. In certain cases, S/L/T agencies have developed more refined region specific growth factors which are then used to replace the EIA/NERC factors developed from other information sources, along with supporting documentation for those growth rates. EIA annual average regional growth factors are calculated by dividing AEO future projected generation by base year generation.

Peak growth rates are derived by determining relative peak growth from NERC Electricity Supply & Demand (ES&D) data and applying it to the annual growth rates. The derived relative peak growth rates are not delineated by fuel so the ratio of peak to nonpeak growth rates for each fuel within a single region is constant.

Nonpeak growth rates are calculated within the ERTAC EGU Tool using annual and peak growth rates. Annual average regional growth rates are adjusted to account for the peak hours.

Peak and nonpeak growth is assigned to every hour by ordering all hours of the year by base year utilization. The peak growth factor is assigned by fuel to a limited number of hours with the highest utilization in the base year. Growth is then transitioned gradually to non-peak growth rate. The number of peak and transition hours are differentiated by fuel and region and are assigned in the Input Variables File. Figure 1 shows graphically the relationship between annual, peak and nonpeak growth rates.

Figure 1: Relationship between the annual, peak, and nonpeak growth rates



Finally, fuel specific hourly regional growth factors are adjusted to account for activity from new units and shutdowns. The tool then applies the adjusted hourly growth factors to the base year hourly generation data to estimate hourly future generation. This generation is assigned to the units burning the specified fuel within the region. After generation is assigned, the tool confirms that unit capacity is not exceeded. If the available capacity is fully utilized new, generic units ("Generation Deficit Units") are created to carry demand that exceeds known unit capacity.

4. NO_X AND SO_2 EMISSIONS

For base year runs, actual CAMD data is averaged to calculate base year ozone season and non-ozone season emission rates.

For future year runs, calculated base year average emission rates for existing units are adjusted to account for new control equipment or other changes provided in the input files.

For new units, two approaches are employed. First, if a state provides new unit emission rates those are used directly. Where emission rates are not provided, these are estimated based on the 90th percentile best performing existing unit for that fuel type and region. The user may adjust this percentile within the input variables file. These rates are applied to each unit's future generation to calculate NO_X and SO_2 emissions.

5. Output

The ERTAC tool generates hourly generation and emissions for each unit included in the system. In addition, post processors create summary files to facilitate review of the results, as follows:

- Annual base and future year generation (MW-hrs), heat input (mmbtu), SO_2, NO_X emission (tons) and average emission rate (lbs/mmbtu)
- Ozone season base and future year generation and heat input, NO_X emission (tons) and average emission rate (lbs/mmbtu)

Post processors are also available to generate CO_2 estimates.

6. Geographic Regional System

Each EGU unit included in the model is assigned to a geographic region and fuel type bin in the Unit Availability File. The geographic regional system provided in Figure 2 is used in versions 2.7 reference and CSAPR Update compliant runs is the EIA Electricity Market Module (EMM) regional system. One adjustment that the EIA EMM system for the ERTAC EGU system is that SPNO and SPSO have been combined into a single region.

Because the EIA EMM and NERC regions are not identical, adjustment is required to align these regional systems to develop annual and peak growth rates. To match EIA and NERC, a "best fit" NERC regional growth factor is assigned to each EMM region. In the simplest case, where a clear match between EIA and NERC regional schemes exists, for example NPCC-New England, the NERC relative peak growth rate is assigned to the corresponding EMM region. In more complicated cases, where multiple EMM regions corresponded to a single NERC region, or where regions were organized along substantially different geographic boundaries, the NERC ES&D data was aggregated and averaged to generate a relative peak growth factor for the (usually larger) corresponding NERC region and was applied to the corresponding ERTAC region (which closely resemble the EMM regions). As an example, the EIA SRVC, RFCW, and RFCE regions corresponds to two NERC regions, PJM and SERC East. In this case, the relative peak growth factors were derived from PJM and SERC East and applied to SRVC, RFCW, and RFCE ERTAC regions.

Within each region, individual generation units are further delineated into five unit types as follows:

- Coal;
- Oil;
- Natural Gas – Combined Cycle;

- Natural Gas – Single Cycle;
- Natural Gas – Boiler gas.

Figure 2: Regional boundaries for coal generation, CONUSv2.7

Figure 4: EMM to NERC Crosswalk – ERTAC EGU V2.7

EMM Fuel Region #	Fuel	EMM Region Name	ERTAC Regional Code	Single "Best-Fit" NERC Subregion Peak Growth Code
1	Coal, NG, Oil	Texas Regional Entity (ERCT)	ERCT	ERCOT
2	Coal, NG, Oil	Florida Reliability Coordinating Council (FRCC)	FRCC	FRCC
3	Coal, NG, Oil	Midwest Reliablity Council / East (MROE)	MROE	MISO / SPP / SERC-N
4	Coal, NG, Oil	Midwest Reliablity Council / West (MROW)	MROW	MISO / SPP / SERC
5	Coal, NG, Oil	Northeast Power Coordinating Council / Northeast (NEWE)	NEWE	NPCC - NE
6	Coal, NG, Oil	Northeast Power Coordinating Council / NYC Westchester (NYCW)	NYCW	NPCC - NY
7	Coal, NG, Oil	Upstate New York (NYUP)	NYUP	NPCC – NY
8	Coal, NG, Oil	Long Island (NYLI)	NYLI	NPCC - NY
9	Coal, NG, Oil	Reliability First Corporation / East (RFCE)	RFCE	PJM / SERC - E
10	Coal, NG, Oil	Reliability First Corporation / Michigan	RFCM	MISO / SPP / SERC
11	Coal, NG, Oil	Reliability First Corporation / West	RFCW	PJM / SERC - E
12	Coal, NG, Oil	SERC Reliability Corporation / Delta (SRDA)	SRDA	MISO / SPP / SERC
13	Coal, NG, Oil	SERC Reliability Corporation / Gateway (SRGW)	SRGW	MISO / SPP / SERC
14	Coal, NG, Oil	SERC Reliability Corporation / Southeastern (SRSE)	SRSE	SERC - SE
15	Coal, NG, Oil	SERC Reliability Corporation / Central (SRCE)	SRCE	MISO / SPP / SERC
16	Coal, NG, Oil	SERC Reliability Corporation / Virginia Carolina (SRVC)	SRVC	PJM / SERC - E
17+18	Coal, NG, Oil	SouthWest Power Pool / North (SPNO) + South (SPSO)	SPPR	MISO / SPP / SERC
19	Coal, NG, Oil	Western Electricity Coordinating Council / Southwest (AZNM)	AZNM	WECC-WECC-SWSG
20	Coal, NG, Oil	Western Electricity Coordinating Council / California (CAMX)	CAMX	WECC-CAMX US
21	Coal, NG, Oil	Western Electricity Coordinating Council / Northwest Power Pool Area (NWPP)	NWPP	WECC-NWPP US
22	Coal, NG, Oil	Western Electricity Coordinating Council / Rockies (RMPA)	RMPA	WECC-WECC-RMRG

7. Details of Version 2.7 Reference and CSAPR Update compliant Runs

ERTAC EGU v2.7 was built on improvements to prior runs and included updates to the UAF and control file from states received as of July. A summary of the inputs used to develop the ERTAC EGU v2.7 Reference and CSPAR Compliant runs for the continental United States are shown in Figures 5 and 6 respectively. Details of these changes may be found in the change log document. (ERTAC 2017a)

ERTAC EGU Code 2.1 – Both V2.7 Reference and CSAPR Update compliant Scenario

Version 2.7 was the first usage of the ERTAC EGU v2.1 code. V2.1 added a new functionality, including the ability to transfer of load between fuel types and regions. Use of this transfer functionality is described later in this document. (ERTAC 2017b)

Regional Boundaries Growth Rates– Both V2.7 Reference and CSAPR Update compliant Scenario

AEO regions SPSO and SPNO were aggregated into a single region called SPPR for the coal fuel type only. - SPP operates as a single balancing authority and single wholesale market for the SPPR region. Hence growth in wholesale power production occurs within that single market construct. Application of differential growth rates by fuel type between SPPS and SPPN obscures that single market construct and can produce counter-intuitive fuel-specific emissions forecasts. Combining the individual net generation forecasts for a single fuel type allows for an accurate averaging of the growth rates into an integrated whole. The anticipated outcome will be more reflective of the generation efficiencies and relative fuel balance based on the application of a single wholesale market construct. Since there have been issues of predicted over-emissions in one or more of the states (most notably Oklahoma) when forecasting the two independent smaller regions within the ERTAC construct, the bigger regional footprint partially alleviates this specific problem due to the rebalanced loading for each fuel-unit type.

Growth Rates – Both V2.7 Reference and CSAPR Update compliant Scenario

Growth factors used in both v2.7 reference and CSAPR Update compliant scenario were developed based on AEO2017 No Clean Power Plan Case. Relative peak factors were derived from 2016 NERC Electricity Supply & Demand (ES&D). The file containing annual and peak growth factors was provided by Tom Shanley of the ERTAC EGU Growth committee and is named:

CONUSv2.7_AEO2017Ref_noCPP_SPPR_T2017_2030_ertac_growth_rates_7-17-2017.xlsx

These growth factors and default growth curve parameters were used with the following exceptions:

- **SRVC**[1] replaced AEO growth rates and growth curve shape with values based on regional knowledge for combined cycle, Boiler gas and simple cycle fuel bins. The updated local

[1] updated using PGR/AGR information in email dated August 8, 2017, transmitted via email from Ming Xie of NC on August 9, 2017.

values were used for all future year projections. Development of the local values is described in a memo included as an appendix to this document. Specific changes include:

  - **Combined Cycle** peak to nonpeak growth transition points were set to 200 and 2000 to reflect the fairly large difference in average and peak growth rates (AGR and PGR).
  - **Boiler Gas and Simple Cycle** transition points were set to 100 and 1000 to reflect the large difference in AGR and PGR and ameliorate the Generation Deficit Units (GDU)
  - Any year not included in the SRVC memo was interpolated between SRVC information.

- **NYCW**[2] replaced AEO annual growth rates with values based on regional knowledge for all fuel bins. The updated local values were developed for 2020 and 2025 and interpolated[3] for use for all future year projections. Development of the local values is described in a memo included as an appendix to this document. Specific changes include: xxx
- **RFCE and RFCM** default growth curve transition points for the combined cycle fuel bin (CC) were replaced with 100 and 1000 to reflect the large growth and increased reliance on CC for base loaded operation in those regions.
- **SRGW** boiler gas peak growth rate for 2028 and 2030 was reduced to 0.98 so that the infinite GDU bug is not triggered. Annual growth rate was not affected.

ERTAC Demand Transfer– Both V2.7 Reference and CSAPR Update compliant Scenario

Demand transfer is a new concept made possible by use of the new v2.1 ERTAC EGU code. The concept is to transfer some demand for particular hours from one fuel bin to alleviate the generation of a GDU. Another use for a demand transfer is the case where a significant system change occurs which was not anticipated by the EIA in the AEO. The example in V2.7 is the retirement of a large nuclear power plant near New York City. This results in other fuel bins having to provide a large amount of generation that was unanticipated by the EIA in the AEO.

Transfers to prevent a coal fired GDU

- **NEWE** 300 MW-hrs was transferred from coal to combined cycle fuel bins in 861 deficit hours to prevent a coal fired GDU. There were 2000 MWs of unused CC capacity in NEWE. This transfer was done in every future year projected.
- **FRCC** Coal generation was transferred to the combined cycle fuel bin for certain hours to prevent a coal fired GDU. There was significant unused combined cycle capacity in FRCC.[4]

[2] NY memo to MARAMA, dated 02-11-2016

[3] 2020 interpolated growth rates were approved by Ona Papageorgiou (NY) in an email dated 8/1/2017 from Ona to D. McLeod (VA)

[4] FL staff (Hastings Read) approved this approach in an email dated August 9, 2017, to D. McLeod, titled, “RE: FRCC updates for ERTAC CONUS2.7.

This transfer was done in every future year projected. However, the amount of generation transferred, and the number of hours required varied by projection year as follows:

- 2017 – No transfer required
- 2018 – 2500 MW-hr coal to CC in 1259 deficit hours
- 2019 – 1000 MW-hr coal to CC in 241 deficit hours
- 2020 – 1300 MW-hr coal to CC in 444 deficit hours
- 2023 – 600 MW-hr coal to CC in 59 deficit hours
- 2025 – 600 MW-hr coal to CC in 90 deficit hours
- 2028 – 1000 MW-hr coal to CC in 2040 deficit hours
- 2030 – 1000 MW-hr coal to CC in 239 deficit hours

Transfers to ameliorate disappearing generation bug

- RFCE – In the 2023 and 2025 projection 300 MWh of coal generation in RFCE was transferred to Combined Cycle for each of 4 hours to ameliorate missing generation due to Utilization Fraction limitations on coal fired units. The table below shows the 4 hours. RFCE combined cycle has significant new capacity in 2023, and at least 1000 MW of unused capacity.

Figure XXX Coal Generation in RFCE Transferred to Combined Cycle to Ameliorate Missing Generation

	B	C	D	E	F	H	I	J	O	P	Q
	ertac_fuel_unit_type_bin	op_date	op_hour	calendar_hour	temporal_allocation_order	base_actual_generation	base_retired_generation	future_projected_generation	afygr	excess_generation_poo	
56	Coal	8/14/2011	14	5415	3471	11353	719.7	10048.17034	0.944971959	39.09317901	
57	Coal	8/14/2011	15	5416	3472	11678.6	718.5	10336.34829	0.943088866	128.5455752	
58	Coal	8/14/2011	16	5417	3473	11809.4	710.3	10452.1151	0.941708346	120.9371685	
59	Coal	8/14/2011	17	5418	3474	11830.9	696.9	10471.14405	0.940465606	82.56722527	
02											
03											

Transfers to address nuclear retirement

- NYCW - Indian Point nuclear power plant is scheduled to retire in 2021. John Barnes of NY (email dated 7/13/2017) advised that the nuclear transfers should be limited to years after 2021. (2021/2023/2028)

Input Variables – Both V2.7 Reference and CSAPR Update compliant Scenario

In SRVC the combined cycle percentile was set at 50th, coal to 70%, and simple cycle to 70th. This was based on region specific sizes, capacities, and characteristics.

Non-CAMD Hourly file– Both V2.7 Reference and CSAPR Update compliant Scenario

A small group of units with abnormal or missing base year hourly data are not assigned any generation by the tool in the future year. To correct this issue, these units are assigned one hour of reasonable, minimal activity in the non-CAMD hourly file to ensure processing. This improvement has negligible impact on base year data.

For ORIS 55178, CT-1 it appears in some hours this unit reported in KW-hr rather than MW-hr, so that certain hours had more than 20,000 MW-hr of production. To correct this issue, any reported load greater than 300 was changed to 300 to fix the 2011 anomalous data. This issue was not discovered in previous runs because the unit had been marked "non-EGU" in prior runs. The state updated this designation to "Full" in the 2.7 comment period, so that the anomalous data became apparent in trial runs[5].

MI and FL supplied gross load data for combined cycle units that did not report power produced from steam generation in the BY CAMD data.

Negative emissions and load values are replaced with zero.

Added a full year of data for:

- ORIS 8906 (Astoria) Unit IDs 30, 40, and 50—summed reheat and superheat reported data to create the pseudo units.
- ORIS 7839 (Ladysmith) Unit 5, which is equivalent to that reported in 2011 for 7838 (Remington) Unit 5. 7838, 5 does not exist. This is a 2011 CAMD reporting error.

Other similar anomalies were corrected and are documented in the Run Log.

Unit Availability File – Both V2.7 Reference and CSAPR Update compliant Scenario

Numerous detailed corrections and adjustments to these files were made for both v2.7 reference and CSAPR Update compliant runs based on S/L/T agency comments regarding the configuration, characteristics, and utilization estimates of their units. The file name for the final unit availability file is: 2011BASEUnit_Availability_v2.7_17noCPPSeptember 192017_code2_1.xls.

Boiler gas treatment: Many coal fired EGU units have recently announced conversions to firing as boiler gas units. This trend results in a future over-capacity of boiler gas capacity and shortfall of coal capacity compared with projected generation in many regions. These conversions have been left in the coal bin in several cases for two reasons:

- To address shortfall created in coal bin resulting in GDU formation to meet coal fired demand.
- To create a reasonable future year generation profile for the unit.

[5] See email from Adel Alsharafi (MO) dated 7/20/2017 to D. McLeod (VA)

To address the shortfall the tool created coal fired Generation Deficit Units to meet the demand for coal fired generation. To ameliorate this imbalance, a decision was made to assign boiler gas characteristics, including emission rates to these units, but to leave them in the coal fuel bin. These units were assigned Utilization fractions typical of existing natural gas-fired boilers in their region. The following units were treated in this fashion:

- 6055, 2B1 (Big Cajun 2, LA) in SRDA. Coal to boiler gas conversion assigned a UF limitation of 0.5
- Xxxx We need a complete list of the units treated in this fashion.

Controls File/Seasonal Controls File - Application of Best Practices NO_X Control Rates to EGU Units With Existing Control Devices – V2.7 CSAPR Update compliant Scenario Only

ERTAC EGU V2.7 reference runs did not result in NO_X emissions that met the regulatory requirement to meet the 2017/2018 CSAPR Update budgets in FY 2023. Due to the conservative nature of SIP development and therefore inventory development, states may not always include lower ozone season NO_X rates in projections for units that have flexibility in how they run controls or combustion processes. To address this issue, the ERTAC committee developed the CSAPR Update scenario to reflect reasonable estimates of improved NO_X rates driven by the requirement to purchase allowances under CSAPR Update in future year projections to demonstrate a first-cut estimate of compliance with state level budgets, assurance levels, or regional budgets associated with the CSAPR Update rule addressing the 2008 ozone NAAQS. Files resulting from this approach to editing the control file and seasonal control file for each run are referred to as the "optimized files." These changes are fully described in the control documentation file titled, "2011BASEControl File-v2.7_17noCPPSeptember 19,2017_code2_1.xls." The descriptions below are background and summaries of the control documentation file.

Development of optimized emission rates. - MD staff prepared an analysis of historical unit performance from 2005-2016 ozone seasons to determine historically best-observed NO_X emission rates for coal-fired units controlled by SCR or SNCR. (Vinciguerra et al 2017) This analysis was based on ERTAC 2.6 results. Based on this analysis it was estimated that 19 units fitted with SNCR could meet an average NO_X rate of 0.125 lbs/mmbtu in the ozone season. Also 141 units fitted with SCR were identified that could meet an average NO_X rate of 0.064 lbs/mmbtu in the ozone season. These average values were selected to represent optimized NO_X rates during the ozone season in the absence of a state-provided optimized NO_X rate. These values may be further updated in later runs to reflect rates from unit-specific analyses.[6] Additionally, OK staff prepared an analysis of ozone season NO_X rates for units within OK not

[6] Email dated 7/12/2017 from H. Ashenafi-MD to D. McLeod-VA contained the updated rates for the various ORIS code/Unit ID combinations.

equipped with post-combustion controls but that have reduced NO_X emissions in 2016 based on CAMD data.[7]

Units for which the optimized control rate were applied - To determine which units would receive optimized NO_X rates, Maryland developed a list of coal-fired EGUs within CSAPR states equipped with SCR or SNCR, and matched this list to the ERTAC 2.7 2023 results. The optimized NO_X rates were applied to SNCR units with a 2023 ozone season NO_X emission rate > 0.125 lbs/mmbtu and SCR units with a 2023 ozone season NO_X rate > 0.064 lbs/mmbtu unless the state already provided an ozone season controlled NO_X rate in the seasonal control file. This resulted in optimized OS rates for 163 units – 124 SCR and 39 SNCR units.

Oklahoma Units – Oklahoma submitted optimized ozone season NO_X rates for the CSAPR Update compliant run for the following additional units not included in Maryland's analysis. These rates are based on 2016 ozone season NO_X data as reported by the Oklahoma units to CAMD. For all units except 2952 Unit 6, the non ozone season rates were based on submitted data in the documentation controls file. For 2952, Unit 6, which had no submitted data, the non-ozone season rates were those supplied by the tool as the non-ozone season average in 2011.

Optimized control emission rates were only applied in the ozone season - The optimized rates were included in the seasonal controls files and applied from May 1 through Sept 30 each year, beginning in 2017. In other periods of the year emission factors were equivalent to the 2011 data for the non-ozone season unless states had provided controlled NO_X rates as inputs. Where states provided a future year controlled NO_X rate that controlled rate was used for the non-ozone season. State provided annual NO_X control information for optimized units was removed from the annual control file to ensure that the ERTAC EGU tool would correctly select the NO_X rate supplied in the optimized seasonal controls file. However, state comments concerning annual controls were preserved in the non-ozone seasonal control file records. The optimized controls file and seasonal controls file can be used for years 2020 and beyond with no further modifications to the files.

- **Controls file:**
  Based on 2011BASEControl File-v2.7_17noCPPSeptember 192017_code2_1.xls.
- **Seasonal Controls File:**
  Based on 2011BASEControl File-v2.7_17noCPPSeptember 1922017_code2_1.xls.
  The following items are documented in the controls file but are also worthy of explanation here:

[7] Email dated 8/3/2017 from T. Richardson-OK to D. McLeod-VA contained the updated rates for the various ORIS code/Unit ID combinations.

- North Carolina submitted a large number of new seasonal control records. For units with a pollutant in the seasonal controls file, those line items were deleted from the controls file. [8]

Figure XXX New Oklahoma Emission Rates based on 2016 CAMD

ORIS	Unit ID	Facility	State	ERTAC Region	Fuel/Unit Type Bin	Previously Submitted or Calculated OS NOx Rate, (lbs/mmbut)	Calc. 2016 CAMD OS NOx Rate (lb/MMBtu)
165	2	Grand River Dam Authority	OK	SPPR	Coal	0.1600	0.1461
2952	6	Muskogee	OK	SPPR	Coal	0.3391	0.2813
2956	1	Seminole (2956)	OK	SPPR	boiler gas	0.2030	0.1061
2956	2	Seminole (2956)	OK	SPPR	boiler gas	0.2120	0.0954
2963	3313	Northeastern	OK	SPPR	Coal	0.1500	0.1317
10671	1A	AES Shady Point	OK	SPPR	Coal	0.1225	0.0712
10671	1B	AES Shady Point	OK	SPPR	coal	0.1245	0.0716
10671	2A	AES Shady Point	OK	SPPR	coal	0.1262	0.0669
10671	2B	AES Shady Point	OK	SPPR	coal	0.1268	0.0662
50558	CC01	Oklahoma Cogeneration LLC	OK	SPPR	combined cycle gas	0.2000	0.1222

[8] See Ming Xie's email from NCDENR, dated 5/26/2017.

8. PRIOR RUNS

Prior reference runs files and documentation using 2011 base year data are as follows:

v2.6 – Run in March, 2017, using input files current as of January 2017, and run by VA DEQ, IN DEP, and OTC in March 2017. Significant change in this run is that boiler gas units in many states, including PA were left in the coal bin and more seasonal controls were added, including MD. Growth factors are based on AEO2015 High Oil and Gas Scenario.

v2.5L2 - Run in August, 2016, using input files current as of August 2016, and run by VA DEQ. Growth factors are based on AEO2015 High Oil and Gas Scenario.

v2.4 – Run in August, 2015, using input files current as of July 2015, and run by VA DEQ. As occurred with v2.3, growth factors are based on AEO2014

v2.3 – Run in October 2014. This run included major updates to the UAF and Control files received as of August 24, 2014. This is the first use of growth rates from AEO2014.

v2.2 – Run in June 2014. Same as v2.1. This run included major updates to the UAF and Control files received as of March 31, 2014. This is the first use of the new code 1.01. Growth rates were from AEO2013.

v2.1L1 – Run in April 2014. Same as 2.1 except this run included updates from Midwest to UAF and control file for Indiana, Illinois, Wisconsin, Michigan and Ohio primarily for coal fired units received dated March 3, 2014.

v2.1 – Run in March 2014. This run included updates to the UAF and control file from several states. UAF updated with adequate data to calculate an ERTAC heat rate. Negative values in CAMD replaced with zero. An adjustment to implement zero growth for the Boiler gas was included. Combustion turbines and combined cycle units were adjusted in the 2.1 factors to account for the boiler-gas generation.

v2.0 – Run in January 2014. This run was the first using base year 2011. In addition, the Midwest states provided updates to the UAF and control files. These updates were completed by the Northeast in prior runs.

FIGURE 3 AND REFERENCES

ERTAC 2017a – Change log

ERTAC 2017b – New Code Document.

Vinciguerra et al., Expected Ozone Benefits of Reducing Nitrogen Oxide (NOx) Emissions from Coal-Fired Electricity Generating Units in the Eastern United States.

US Energy Information Administration 2017, *Annual Energy Outlook 2017 with Projections to 2050*, accessed from https://www.eia.gov/outlooks/aeo/.

summarize the inputs to v2.7 Reference and CSAPR Update compliant runs, respectively.

Figure 3: Inputs to ERTAC EGU v2.7 Projection Runs

ERTAC File Name	Description	Run Notes
OVERVIEW	Version 2.7	Run by VA DEQ - Doris McLeod , OTC-Joseph Jakuta in Aug-Sep 2017
	Code: 2.1	New code, with new ertac_demand_transfer feature. Also, used a file converter for the new code to update to v2.1 format the UAF and input variables. This set of runs will be the only set using the file converter. Next runs will start with the v2 formats.
	Base Year: 2011	
	Future Years: 2017, 2018, 2019, 2020, 2023, 2025, 2030 (in nomenclature of files, XX denotes year, example 17 = 2017)	Note that years 2020-2030 have both ref and opt runs. Ref indicates all inputs are based on state supplied data. Opt indicates that state supplied data was augmented with MD optimization control strategy, and OK supplied unit-specific data solely for optimization runs.
camd_hourly_base.csv	Hourly CAMD CEM data	Same for all years.
ertac_hourly_noncamd.csv	Hourly CEM data replacing data in CAMD	C2.1CONUSv2.7_ertac_nonCAMD_hourly.csv Same for all years
	Added MO unit to correct hourly data that was reported in the wrong units (kW instead of GW)	
ertac_initial_uaf.csv	Unit Availability File	C2.1CONUSv2.7_20XX_ertac_initial_uaf.csv (based on final Sept 2017 documentation file.) Same for all years Files were run through the file converter to create the new code input file, ertac_initial_uaf_v2.csv
ertac_control_emissions.csv	Annual Control File	C2.1CONUSv2.7ref_20XX_ertac_control_emissions.csv, C2.1CONUSv2.7opt_ertac_control_emissions.csv (based on final Sept2017 controls file) Same for all years.
	For 2.7, two control files were used. One is the reference case (ref) that includes only those controls supplied by states. One is an optimized file (opt) that removes certain SCR/SNCR coal fired units and certain OK units since they were moved to the seasonal controls file.	
ertac_seasonal_control_emissions.csv	Seasonal Control File	C2.1CONUSv2.7ref_20XX_ertac_control_emissions.csv (based on final Sept2017 controls file) and C2.1CONUSv2.7opt_20XX_ertac_control_emissions.csv Same for all years. For 2.7, two seasonal control files were used. One is the reference case (ref) that includes only those controls supplied by states. One is an optimized file (opt) that includes state data as well as additional ozone season information for certain SCR/SNCR coal fired units and certain OK units. For the optimized units, only OS NOx rates were reduced. NOx rates in other months were left equivalent to reference case information.
	For 2.7, two seasonal control files were used. One is the reference case (ref) that includes only those controls supplied by states. One is an optimized file (opt) that includes state data as well as additional ozone season information for certain SCR/SNCR coal fired units and certain OK units. For the optimized units, only OS NOx rates were reduced. NOx rates in other months were left equivalent to reference case information.	
ertac_growth_rates.csv	Growth Files	C2.7CONUSv2.7ref_20XX_ertac_growth_rates.csv
	Based on AEO 2017 no CPP rates. Used NYCW and SRVC specific growth rates. NYCW did not have updated values. SRVC provided updated values.	
ertac_input_variables.csv	Input Variables File	C2.7CONUSv2.7ref_20XX_ertac_input_variables.csv Code 1.01 files were run through the file converter to create the Code 2.1 input file called ertac_input_variables_v2.csv
ertac_demand_transfer.csv	Transfers of power between regions, fuel/unit types, into or out of systems from renewables and nuclear, etc	C2.7CONUSv2.7ref_20XX_ertac_demand_transfer.csv. Different for all years.
group_total_listing.csv	Aggregation scheme for multi-state caps	C2.7CONUSv2.7ref_20XX_group_total_listing.csv (same for all years) Updated to include latest CSAPR update values
state_total_listing.csv	Aggregation scheme for state level caps	C2.7CONUSv2.7ref_20XX_state_total_listing.csv (same for all years) Updated to include latest CSAPR update assurance level values.

ERTAC File Name	Description	Run Notes
OVERVIEW	Version: 2.7 Reference	Run by VA DEQ - Doris McLeod Sep 2017.
	Code: 2.1	
	Base Year: 2011	Update to UAF, Controls, and nonCAMD hourly. States feedback deadline: June, 2017.
	Future Years: 2020, 2021, 2023, 2025, 2028, and 2030	
camd_hourly_base.csv	Hourly CAMD CEM data	
ertac_hourly_noncamd.csv	Hourly CEM data replacing data in CAMD	C2.1CONUSv2.7_ertac_nonCAMD_hourly.csv
	Updates include adding one hour of reasonable, minimal data to approximately 44 units that Emily Bull (MDE) identified as missing in output files to allow the tool to process these units fully.	
ertac_initial_uaf.csv	Unit Availability File (XX denotes year, example 17 = 2017)	C2.1CONUS2.7_20XX_ertac_initial_uaf.csv: Updates include state inputs and regional boundaries for MROS.
ertac_control_emissions.csv	Annual Control File (XX denotes year, example 17 = 2017)	CONUSv2.7ref_20XX_05052016_ertac_control_emissions.csv
ertac_seasonal_control_emissions.csv	Seasonal Control File (XX denotes year, example 17 = 2017)	C2.1CONUSv2.7_20XX_ertac_seasonal_control_emissions.csv
	Seasonal controls provided by VA, GA, PA (Brunner Island Units 1, 2 & 3 have lower NOX and SO2 rates during the ozone season to represent NG firing.) and MD & NJ	
ertac_growth_rates.csv	Growth Files (XX denotes year, example 17 = 2017)	CONUSv2.7ref_20XX_05052016_ertac_growth_rates.csv
	ANNUAL GROWTH rates spreadsheet supplied by T. Shanley of MI DEQ called AEO2017 GRs.xlsx. Adjustments to	
		SRVC - Peak and annual growth rates supplied by NC for SC, NC, VA and WV.
		NYCW - GRs supplied by NY in memo to MARAMA.
	PEAK GROWTH Rate spreadsheet supplied by T. Shanley (MI) called Gas_Adj_AEO2014_NERC2013 Growth Rates v4	
		SRGW peak growth rate for oil was set to 2.0 to ameliorate an extremely high peak rate, per LADCO.
		SRSE peak GRs and transition hours adjusted for Coal, CC, SC, BG as in Lopez (MI) email to Byeong Kim (GA) 7/20/2017 with subject "SRSE Peak Growth Rate Adjustments"
		COMBINED CYLE GAS: Ameleoration of GDUs created solely for Peak hour demand deficits
		RFCM, MROZ, and MROW combined cycle peak growth rate set to 1.3 and transition hours peak->formula set to 200; formula-> nonpeak set to 2000 based on LADCO, WI, and MI input. All other transition hours remain at default levels.
		CAMX, ; NWPP; RFWZ; SRCE; SRGW Combined cycle gas peak 2028 GR set to 1.3 and transition hours set to 200 and 2000.
	EMM to NERC Crosswalk	SPPR – Two AEO regions, SPPN and SPPS, were aggregated for the coal fuel type only.
ertac_input_variables.csv	Input Variables File (XX denotes year, example 17 = 2017)	C2.1CONUSv2.7_20XX_ertac_input_variables.csv
group_total_listing.csv	Aggregation scheme for multi-state caps (XX denotes year, example 17 = 2017)	C2.1CONUSv2.7_20XX_group_total_listing.csv
state_total_listing.csv	Aggregation scheme for state level caps (XX denotes year, example 17 = 2017)	C2.1CONUSv2.7_20XX_state_total_listing.csv

References

ERTAC 2017a – Change log

ERTAC 2017b – New Code Document.

Vinciguerra et al., Expected Ozone Benefits of Reducing Nitrogen Oxide (NOx) Emissions from Coal-Fired Electricity Generating Units in the Eastern United States.

US Energy Information Administration 2017, *Annual Energy Outlook 2017 with Projections to 2050*, accessed from https://www.eia.gov/outlooks/aeo/.